Global Trends: Passenger Mobility and Freight Activity

Global economic growth and the integration of trade, finance, and manufacturing continue to widen and intensify. Expanding passenger mobility and freight activity both facilitate and are a result of this growth and integration. This chapter explores global changes in passenger mobility and freight activity and their implications and impacts. It reviews trends in countries belonging to the Organization for Economic Cooperation and Development (OECD),[1] the former East Bloc (FEB),[2] and in other non-OECD countries.[3] The chapter shows that almost all countries—developed and developing—are facing similar transportation challenges resulting from increasing mobility and freight activity, as well as a shift in modes. It also shows that all countries are struggling to find and apply appropriate solutions. The final section discusses the implications of changing mobility in passenger and freight transportation worldwide.

[1] In 1997, OECD member countries are: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Hungary, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, South Korea, Spain, Sweden, Switzerland, Turkey, the United Kingdom, and the United States. Poland and Hungary are included here with the former East Bloc countries and South Korea with non-OECD countries, because the data and information used in this chapter predates their entry into the OECD.

[2] FEB refers to countries of central and eastern Europe, Russia, and other republics of the former Soviet Union.

[3] This chapter often refers to non-OECD countries as "developing countries," even though the state of economic development among this group varies widely.

As discussed in chapters 6, 7, and 9, various statistical indicators are necessary to assess trends in mobility and freight activity. In passenger transportation, mobility can be defined as the potential for movement. Chapter 7 focused on personal mobility in the United States, and chapter 9 on freight activity. Mobility was measured in physical terms, such as vehicle- or passenger-miles traveled (pmt) and ton-miles. In this chapter, international standard metric units are used, such as the annual number of vehicle-kilometers traveled (vkt) or passenger-kilometers traveled (pkt). This chapter combines data for travel, including vkt and pkt, with inventory data on the number of motor vehicles as surrogates for personal mobility. Freight activity can be measured by commercial vkt, metric tons, metric ton-kilometers (mtk), or average trip distance. This chapter uses the number of mtk as the best available surrogate for freight activity. Lastly, the chapter presents mobility and activity indicators on a per capita, per household, or per vehicle basis whenever possible to permit better international comparison.

Because the quality and quantity of passenger and freight data vary greatly across countries, the discussion is illustrative rather than definitive (see box 10-1). In addition, as the data used here are national in scope, they may mask important differences at the local and regional levels in many countries.

Box 10-1.
Data Difficulties and Limitations

Inconsistent and inadequate data hamper the comparison of transportation systems and policies across countries. The data in this chapter should be thought of as allowing only approximations, not precise country and regional comparisons. Still, as the reader of this chapter will find, even allowing for data problems, trends are clear and some conclusions are evident. The two main categories of data problems are availability and methodology.

Industrialized countries, including the United States, Japan, and Western Europe, have data that are relatively comprehensive and readily available. Developing country data are often less accessible and much less extensive. A few organizations develop and publish detailed and somewhat comparable sets of trend statistics. These are often limited, however, to a specific set of countries or to a specific mode. Without such cross-country statistical sources, national data must be used, where available. This can be a complex undertaking, because transportation-related datasets may be provided by more than one government agency.

The availability of passenger and freight data varies by data category. In general, passenger data are more robust and usually include several indicators such as passenger- or vehicle-kilometers traveled, or numbers of vehicles, although more data are available for road transportation than for other modes. In contrast, data on freight transportation are often limited to indicators of metric ton-kilometers and modal share. Measures of origin and destination, average distance shipped per mode, and intermodal shipments are often not available.

In addition to the lack of data, definitions and collection methodologies differ among countries. For example, countries generally collect travel data through national surveys and may define the term "trip" differently, which affects response rates. Collection methodologies in some countries may lead to an underreporting of modes such as bicycling and walking. In addition, some countries, such as Canada, collect statistics on personal mobility in a way that is not directly comparable to U.S. statistics.

Global Trends and Factors

While the pace and extent of change vary, common trends are underway worldwide. For both passenger and freight transportation, motor vehicles are gaining increasing modal shares, often at the expense of other modes. At the same time, many countries are also experiencing rapid growth in passenger and freight air transportation, although it accounts for a relatively small modal share. In general, these changes are occurring faster in countries with rapidly developing economies than they are in already industrialized

countries. Table 10-1 provides a snapshot of transportation infrastructure in several countries.

Passenger Mobility

Passenger mobility, whether measured by pkt or vkt or the number of motor vehicles, has increased worldwide in the last 20 years. Growth in the use of passenger cars[4] and similar vehicles dominates all the statistics on increased mobility. In addition, air transportation is responsible for a small but rapidly growing part of domestic passenger travel worldwide. Domestic passenger air travel increased an average of 2.5 percent annually (measured in pkt) between 1985 and 1994 worldwide, although this growth was even more rapid in some countries and regions. (OECD 1997) Indeed, in many countries, air travel has been the fastest growing mode of passenger transportation in recent decades. (IEA 1996a, 47)

Motor vehicles, particularly private passenger cars, are now dominant in most OECD countries and are gaining modal share elsewhere. In 1994, automobiles and similar passenger vehicles accounted for 86 percent of the pkt in the United States and 52 percent in Japan, while they accounted for 80 percent of pkt in Western Europe in 1993 (see figure 10-1). In China, passenger road transportation (buses and cars) edged out rail in 1992 to take 46 percent of all passenger-kilometers traveled. (World Bank 1994a) Data are not available for private cars in India, but road transportation accounts for an estimated 85 percent of passenger travel in 1992. (World Bank 1995b)

Between 1970 and 1990, growth in both the number of cars and in highway travel was higher in Europe and Japan than in the United States, as shown by figure 10-2. The United States, however, continues to have more automobiles and more automobiles per capita than any other country. In 1991, the most recent year for which comparative data are available, the United States also led in overall mobility, with 24,331 pkt (15,119 pmt) per person. (As reported in chapter 1, the per capita U.S. figure for 1995 was 26,554 pkt (16,500 pmt) by motor vehicles and 27,681 pkt (17,200 pmt) by all forms of transportation.) Most Europeans traveled half as much; people in developing countries traveled considerably less (see table 10-2).

Non-OECD countries added cars at almost twice the rate as did OECD countries from 1970 to 1990, and accounted for 19 percent of the world's passenger cars in the early 1990s. (OECD 1995) Still, passenger rail and nonmotorized transport (such as bicycles and walking) remain important contributors to mobility. In general, people in developing countries travel less than those in developed countries because of immature transportation systems; less disposable income; limited access to cars, buses, and trains; and more congested urban areas.

Freight Activity

As with passenger travel, freight activity is increasing worldwide, with domestic metric ton-

[4] The term passenger car is used in this chapter to refer to several categories of vehicles. For the United States, this category includes automobiles, taxis, and light trucks. Japan's passenger car category is broken down into cars for private and commercial use. Since 1987, Japan has separately counted trucks for private use, but aggregates the data under its motor vehicle category, which includes buses, passenger cars, and trucks for private use. The European Conference of Ministers of Transport (ECMT) compiles "road passenger transport" data in three categories: cars and taxis; two-wheeled motor vehicles; and coaches, buses, and trolley buses. ECMT's car and taxi data are comparable to OECD passenger car data. OECD's passenger car data refer to passenger cars seating not more than nine persons (including driver), rental cars, taxis, jeeps, and estate cars/station wagons and similar light, dual-purpose vehicles. Other countries are often less specific and may break down surface passenger data into only a general road category.

Table 10-1.

Transportation Infrastructure in Selected Countries: An Overview

(Data for 1995 or most recent year available)

OECD countries	
United States[1]	*Railroads.* 213,000 km main line (Class I and Amtrak) routes *Highways.* 6,296,000 km; 3,819,000 km paved *Inland waterways.* 41,000 km, excluding the Great Lakes and St. Lawrence Seaway *Pipelines.* 183,000 km for crude oil; 139,000 km for petroleum products; 2,029,000 km for natural gas *Airports.* 18,224
Canada	*Railroads.* 78,148 km (1994) *Highways.* 849,404 km; 253,692 km paved (1991) *Inland waterways.* 3,000 km, including the St. Lawrence Seaway *Pipelines.* 23,564 km for crude and refined oil; 74,980 km for natural gas *Airports.* 1,386
France	*Railroads.* 34,074 km (1994) *Highways.* 1,511,200 km; 811,200 km paved (1992) *Inland waterways.* 14,932 km; 6,969 km heavily traveled *Pipelines.* 3,059 km for crude oil; 4,487 km for petroleum products; 24,746 km for natural gas *Airports:* 476
Germany	*Railroads.* 43,457 km (1994) *Highways.* 636,282 km; 501,282 km paved (1991) *Inland waterways.* 5,222 km (1988) *Pipelines.* 3,644 km for crude oil; 3,946 km for petroleum products; 97,564 km for natural gas (1988) *Airports.* 660
Italy	*Railroads.* 19,503 km *Highways.* 305,388 km; 277,388 km paved (1992) *Inland waterways.* 2,400 km *Pipelines.* 1,703 km for crude oil; 2,148 km for petroleum products 19,400 km for natural gas *Airports.* 138
Japan	*Railroads.* 27,327 km (1987) *Highways.* 1,111,974 km; 754,102 km paved (1991) *Inland waterways.* 1,770 km *Pipelines.* 84 km for crude oil; 322 km for petroleum products 1,800 km for natural gas *Airports.* 175
Mexico	*Railroads.* 24,500 km *Highways.* 242,300 km; 84,800 km paved *Inland waterways.* 2,900 km *Pipelines.* 28,200 km for crude oil; 10,150 km for petroleum products; 13,254 km for natural gas; 1,400 km for petrochemical *Airports.* 2,055
United Kingdom	*Railroads.* 16,888 km *Highways.* 360,047 km, including Northern Ireland; 360,047 km paved, including Northern Ireland *Inland waterways.* 2,291 *Pipelines.* 933 km for crude oil; 2,993 km for petroleum products; 12,800 km for natural gas *Airports.* 505

Table 10-1.

Transportation Infrastructure in Selected Countries: An Overview *(continued)*

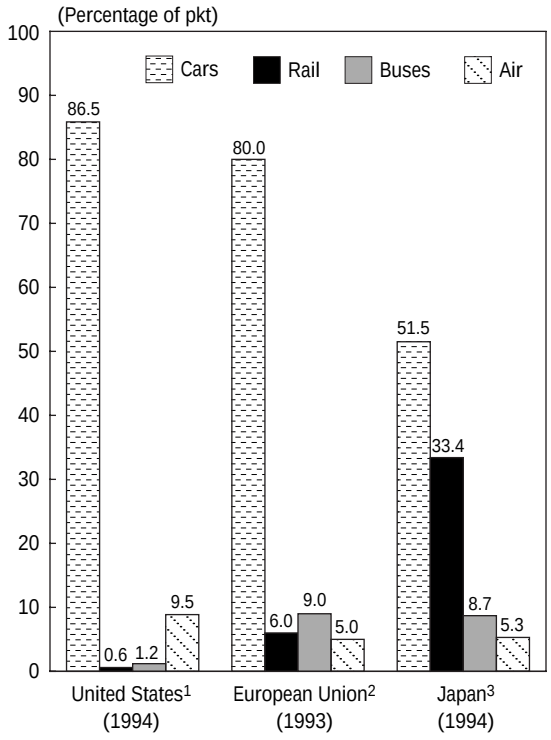
(Data for 1995 or most recent year available)

Former East Bloc countries	
Czech Republic	*Railroads.* 9,434 km (1988) *Highways.* 55,890 km (1988); paved not available *Inland waterways.* Not available *Pipelines.* 5,400 km for natural gas *Airports.* 116
Hungary	*Railroads.* 7,785 km (1994) *Highways.* 158,711 km; 69,992 km paved (1992) *Inland waterways.* 1,622 km (1988) *Pipelines.* 1,204 km for crude oil; 4,387 km for natural gas (1991) *Airports.* 78
Poland	*Railroads.* 25,528 km (1994) *Highways.* 367,000 km, excluding farm, factory, and forest roads; 235,247 paved, of which 257 km are limited access expressways (1992) *Inland waterways.* 3,997 km (1991) *Pipelines.* 1,986 km for crude oil; 360 km for petroleum products; 4,600 km for natural gas (1992) *Airports.* 134
Russian Federation	*Railroads.* 154,000 km (1994) *Highways.* 934,000 km (445,000 km serve specific industries or farms and are not available for common carrier use); 725,000 km paved or graveled (1994) *Inland waterways.* 101,000 km (1994) *Pipelines.* 48,000 km for crude oil; 15,000 km for petroleum products; 140,000 km for natural gas (1993) *Airports.* 2,517
Non-OECD countries	
Brazil	*Railroads.* 30,612 km (1992) *Highways.* 1,617, 148 km; 161,503 km paved (1991) *Inland waterways.* 50,000 km navigable *Pipelines.* 2,000 km for crude oil; 3,804 km for petroleum products 1,095 km for natural gas *Airports.* 3,467
China	*Railroads.* 65,780 km *Highways.* 1,029,000 km; 170,000 km paved (1990) *Inland waterways.* 138,600 km; 109,800 navigable *Pipelines.* 9,700 km for crude oil; 1,100 km for petroleum products; 6,200 km for natural gas (1990) *Airports.* 204
India	*Railroads.* 62,211 km (1994) *Highways.* 1,970,000 km; 960,000 km paved (1989) *Inland waterways.* 16,180 km *Pipelines.* 3,497 km for crude oil; 1,703 km for petroleum products; 902 km for natural gas (1989) *Airports.* 352

[1] See chapter 1 for a fuller description of the U.S. transportation system.

SOURCES:
For the United States: U.S. Department of Transportation, Bureau of Transportation Statistics. 1996. *National Transportation Statistics 1997.* Washington, DC. December.
For other countries: U.S. Central Intelligence Agency. 1996. *The World Fact Book 1995.* Washington, DC.

Figure 10-1.
Modal Shares



[1] United States. Car total includes data for passenger cars, taxis, and light trucks. Rail total includes light rail, heavy rail, and commuter and intercity rail. Bus total includes data for transit motor buses and intercity buses. Air total includes data for certificated air carriers, domestic carriers, and general aviation.

[2] European Union. Car total includes data for private cars. Rail total includes data for intercity and commuter rail, and light rail (where available). Bus total includes local buses and intercity coaches. Air total includes domestic carriers.

[3] Japan. Car total includes data for private and commercial passenger cars. Rail total includes Japan railways and private rail. Bus total includes buses for private and commercial use. Air total includes general aviation and domestic carriers.

KEY: pkt = passenger-kilometers traveled.

SOURCES:
For United States: U.S. Department of Transportation, Bureau of Transportation Statistics. 1996. *National Transportation Statistics 1997*. Washington, DC. December.
For Europe: European Commission. 1995. *The Trans-European Transport Network. Transforming a Patchwork into a Network*. Brussels, Belgium.
For Japan: Japan Ministry of Transport. 1996. *National Transportation Statistics Handbook 1995*. Tokyo. 15 February.

kilometers increasing in most countries over the past 25 years.[5] Road transportation has become more dominant, and the percentage claimed by air freight has grown rapidly in many countries (although air remains a small and specialized part of freight activity).

Average annual growth rates in domestic freight activity vary a good deal among countries. OECD members increased their domestic freight activity at an annual rate of between 1 percent (e.g., France, the United Kingdom, and the Netherlands) and 4 percent (e.g., Italy, Japan, and Spain) between 1970 and 1994. In the United States, freight activity increased 2 percent annually during this same period (and, as reported in chapter 1, this 2 percent growth rate continued through 1995). Freight activity grew much more rapidly in some developing countries. China saw a 7.5 percent annual increase between 1970 and 1992. From 1970 to 1994, however, freight activity in the FEB grew much more slowly and inconsistently, and, in some cases, declined.

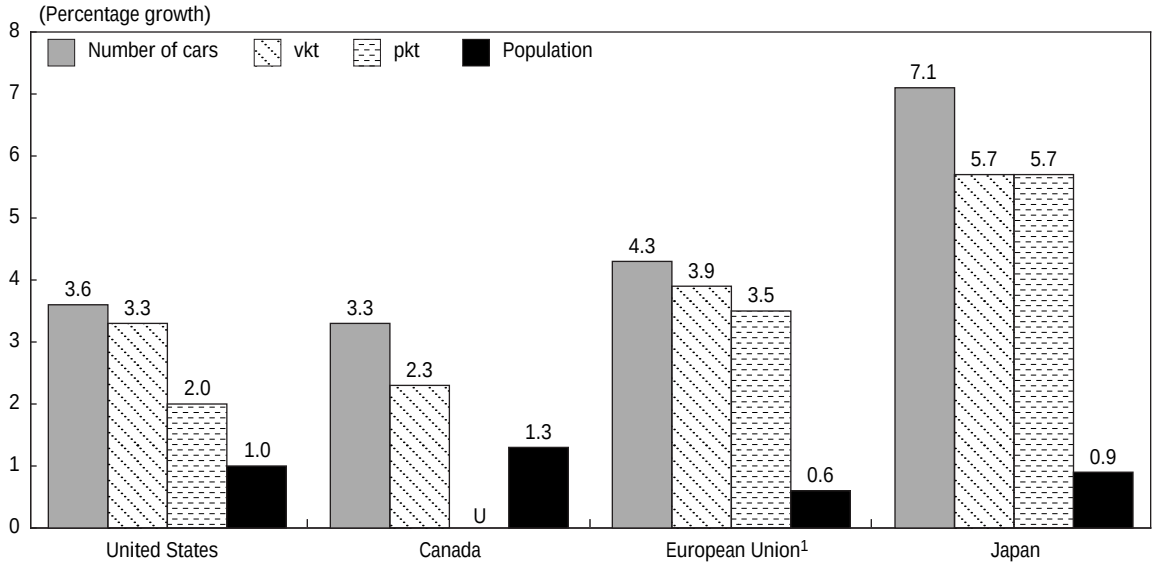
Most of the world's domestic freight activity, on either an absolute or a per capita basis, is concentrated in OECD countries, especially the United States. In 1994, U.S. domestic freight activity was estimated at 5.13 trillion mtk.[6] (USDOT BTS 1996a) In comparison, domestic freight activity in Western Europe was 1,430 billion mtk (979 billion ton-miles), and in Japan equaled 557 billion (382 billion ton-miles).[7] It should be noted that the relatively larger area and lower population density of the United

[5] This chapter focuses on domestic freight activity within countries and regions worldwide. It does not report the growth in freight traffic between countries (i.e., international trade). International freight transportation for the United States is discussed in chapter 9.

[6] The estimate includes mtk for oil pipeline, Class I rail, intercity truck, Great Lakes and inland waterways, and domestic coastwise shipping. Non-Class I rail, local trucking, and domestic air carrier services are not included.

[7] The Japanese data are for 1991.

Figure 10-2.
Average Annual Growth Rate of Passenger Cars and Their Use, in Relation to Population: 1970–90



[1] Member states of the European Union are Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, and the United Kingdom.

KEY: vkt = vehicle-kilometers traveled; pkt = passenger-kilometers traveled; U = data are unavailable.

NOTE: Several types of motor vehicles may be included in the car category for different countries. See footnote 4 in the text for further discussion.

SOURCES:
For United States:
U.S. Department of Transportation, Federal Highway Administration. Various years. *Highway Statistics.* Washington, DC.
U.S. Department of Transportation, Bureau of Transportation Statistics. 1996. *National Transportation Statistics 1997.* Washington, DC. December.
Organization for Economic Cooperation and Development. 1995. *Environmental Data 1995.* Paris, France: OECD Publication Services.
For other countries:
Organization for Economic Cooperation and Development. 1992. *Environmental Data 1992.* Paris, France: OECD Publication Services.
_____. 1995. *Environmental Data 1995.* Paris, France: OECD Publication Services.
Japan Ministry of Transport. 1996. *National Transportation Statistics Handbook 1995.* Tokyo, Japan. 15 February.
European Commission. 1995. *The Trans-European Transportation Network: Transforming a Patchwork into a Network.* Brussels, Belgium.

States tends to generate more metric ton-kilometers because of the greater distances that need to be overcome in moving goods between production and consumption centers. On a per capita or "freight intensity" basis, the United States similarly led other countries with 19,683 mtk (13,482 ton-miles) per capita in 1994 compared with 10,112 mtk (6,926 ton-miles) for Canada and 1,752 mtk (1,200 ton-miles) for China (see table 10-3).

The nature of freight activity is also changing worldwide. Between 1970 and 1994, the use of road transportation grew faster than that of other modes in many countries, thus increasing trucking's modal share, often at the expense of rail. A variety of factors, including geography and business production changes, influence the rate of growth and the extent of the shift among modal shares. The shift toward road transportation has been most pronounced in non-OECD countries, although several OECD countries, particularly those in Western Europe, have very high proportions of road freight transportation.

Demand for faster and more efficient delivery of higher value, lower weight, high-technology goods has influenced the rapid growth of air freight in many countries in recent decades. Express delivery companies such as Federal

Table 10-2.

Domestic Passenger-Kilometers Traveled per Capita, Selected Countries: 1991

Country	Passenger-kilometers traveled: Total passenger travel (billions)	Passenger-kilometers traveled: Per capita
OECD countries		
United States[1]	6,134.7	24,331
Mexico[2]	301.1	3,428
Western Europe[3]	4,250.0	11,535
Japan[4]	1,331.0	10,741
Former East Bloc countries		
Russian Federation[5]	1,000.0	7,194
Hungary[6]	76.1	7,354
Non-OECD countries		
China[7]	617.8	537
Brazil[8]	667.0	4,374

[1] U.S. total includes light and heavy rail, and commuter and intercity rail; trolley, motor, and intercity bus; automobile, taxi, motorcycle, light truck; and air travel by certificated domestic air carriers and general aviation.
[2] Mexican total includes travel by road, rail, water, and domestic air.
[3] Includes Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, and the United Kingdom. Western European total includes travel by bus and coach, rail, private auto, and domestic air.
[4] Japan total includes rail, bus (commercial and private use), passenger car (commercial and private use), private-use truck, and water.
[5] Russian total includes rail, bus, private auto, taxi, and domestic air.
[6] Hungarian total includes national rail, auto and taxi, and coach, bus, and trolleybus.
[7] China total includes rail, road, water, and civil aviation.
[8] Brazil total includes private and public road transport, rail, and domestic air.

SOURCES:
United States: U.S. Department of Transportation, Bureau of Transportation Statistics. 1996. *National Transportation Statistics 1997.* Washington DC. December.
Mexico: Secretaria de Communicaciones y Transportes/Instituto Mexicana del Transporte. 1995. *Manual Estadistico del Sector Transporte 1993.* Mexico City, Mexico.
Western Europe: European Commission. 1995. *The Trans-European Transport Network: Transforming a Patchwork Into a Network.* Brussels, Belgium.
Hungary: European Conference of Ministers of Transport. 1994. *41st Annual Report: Activities of the Conference.* Paris, France: Organization for Economic Cooperation and Development.
Japan: Japan Transport Economics Research Center. 1995. *Transportation Outlook in Japan, 1994.* Tokyo, Japan.
Russian Federation: World Bank. 1993. *Transport Strategies for the Russian Federation.* Washington, DC.
China: Ministry of Communications. 1992. *Statistical Yearbook of China 1992.* Beijing, China.
Brazil: Ministerio Dos Transportes, Empresa Brasileira de Planejamento de Transportes. 1995. *Anuario Estatistico dos Transportes: 1995.*

Table 10-3.

Domestic Freight Intensities, Selected Countries: 1994

Country	Metric ton-kilometers per capita[1]	GDP per capita (1994 U.S. dollars)[2]
OECD countries		
United States	19,683	$25,505
Canada	10,112	18,562
Mexico (1993)	2,204	4,266
Japan (1991)	4,491	36,740
Western Europe		
Germany (1993)	4,271	25,133
France	3,454	22,953
Italy	3,892	17,916
United Kingdom	2,821	17,427
Former East Bloc countries		
Czech Republic	4,799	3,499
Hungary	2,588	4,072
Poland	3,294	2,415
Non-OECD countries		
China (1992)	1,752	439

[1] Excludes domestic air freight. Total includes data for rail, road, inland waterways, and coastal shipping where applicable and when available.
[2] Gross domestic product components are calculated at purchaser values for the United States, Canada, France, Italy, Japan, Mexico, the Czech Republic, Hungary, and China.

SOURCES: United States: U.S. Department of Transportation, Bureau of Transportation Statistics. 1996. *National Transportation Statistics 1997.* Washington, DC. December.
Canada: Transport Canada. 1996. *T-Facts,* 1996-09-26. Ottawa.
Mexico: Secretaria de Communicaciones Transportes/Instituto Mexicano del Transporte. 1995. *Manual Estadistico del Sector Transporte 1993.* Mexico City.
Japan: Japan Transport Economics Research Center. 1995. *Transportation Outlook in Japan, 1994.* Tokyo.
Western Europe: European Conference of Ministers of Transport. 1995. *Activities of the Conference: Resolutions of Ministers of Transport and Reports Approved in 1995.* Paris, France: OECD Publications Service.
___. 1995. *European Transport Trends and Infrastructural Needs.* Paris, France: OECD Publications Service.
___. *Transport: New Problems, New Solutions.* Paris, France: OECD Publications Service.
Former East Bloc countries: European Conference of Ministers of Transport. 1995. *Activities of the Conference: Resolutions of Ministers of Transport and Reports Approved in 1995.* Paris, France: OECD Publications Service.
___. 1996. *Transport: New Problems, New Solutions.* Paris, France: OECD Publications Service.
China: Ministry of Communications. 1992. *Statistical Yearbook of China 1992.* Beijing.
GDP: World Bank. 1995. *World Bank Atlas 1996.* Washington, DC.

Express and DHL emerged to meet this demand. According to the International Civil Aviation Organization, domestic and international air freight rose an average of 7.5 percent per year worldwide between 1985 and 1994. (OECD 1997) Other sources indicate similar trends. European Union (EU) data show an annual increase of 4 percent in air freight between 1970 and 1991. (Banister and Berechman 1993, 19) During this same period, domestic air freight expanded an average of 6.9 percent per year in the United States. (USDOT BTS 1996a) In Japan, domestic air freight grew an average of 12.1 percent annually although its modal share is still very small. (JTERC 1995)

Influencing Factors

Shifts over time in passenger and freight activity can be traced to changes in social functions, the economy, population, government policies, and to advances in technology. These factors, which vary in importance by country and region, interact in complex ways. Table 10-4 presents socioeconomic factors for several countries.

Passenger Mobility

Many of the factors affecting personal mobility trends in the United States that are discussed in chapter 7 also apply in other countries. For example, in many OECD countries there has been a shifting of population and workplaces from urban centers to more dispersed, suburban locations. Suburbanites are more likely to use cars and roads for access to jobs and other activities. Suburbs also have lower population densities than urban centers, making mass transportation less economical, while the population and job shifts out of the city also mean that traditional transit patronage falls. In many developing countries, however, people are migrating from the countryside to larger urban areas and capital cities for jobs and other opportunities. In all cases, the urban poor face problems of transportation accessibility and cost, while transit operators are hard pressed to provide services without increased resources.

Labor force participation has increased in almost all countries, largely because of a rise in the number of working women. Women entering the workforce tend to increase rates of automobile ownership and use.

Population growth increases the demand for transportation. The age distribution of a population also influences demand, because young people and old people tend to travel less than those in the 20- to 50-year-old age group. Age distribution can affect mode preferences. For example, young adults may be more accepting of bus and train transportation (or have fewer alternatives) than middle-aged people who want the convenience of and are able to pay for private automobile travel. Population density also can affect modal preferences and the availability of transportation.

Rising personal income, which has occurred in most countries, is associated with increasing automobile ownership and passenger travel by other modes. Other factors, however, temper the effect of rising wealth. Singapore and Hong Kong, despite their high per capita incomes, have relatively low automobile ownership rates. One reason is geography: both are small city-states where travel distances are short. (USDOT BTS 1996b)

Government policies can promote or discourage certain modes. Examples of government policies include funding for road and airport construction, public transit subsidies, the provision of bicycle lanes and parking facilities, fuel and automobile taxes, highway tolls, auto-free zones, and special transit lanes. Deregulation and privatization of transportation supply are underway in many countries. Parts of the British railway system have been privatized, as has been

Table 10-4.

Socioeconomic Indicators, Selected Countries

Country	Area (thousands of square meters)	Population (thousands, 1994)	Population growth rate (1985–94)	Inhabitants per square kilometer (1994)	Urban population as percentage of total population 1970–1994		Gross domestic product[1] (GDP–U.S. dollars in millions, 1994)	Real average annual GDP growth rate 1970–94[2]
OECD countries								
United States	9,373	260,651	1.0	27.8	74%	76%	$6,648,013	2.8%
Canada	9,976	29,251	1.3	2.9	76	77	542,954	3.6
France	549	57,960	0.5	105.6	71	73	1,330,381	2.5
Germany	357	81,407	0.5	228.1	80	86	2,045,991	U
Italy	301	57,190	0.1	189.9	64	67	1,024,634	2.7
Japan	378	124,960	0.4	330.8	71	78	4,590,971	3.7
Mexico	1,973	88,402	2.2	44.8	59	75	377,115	3.4
United Kingdom	245	58,375	0.3	238.5	89	89	1,017,306	2.3
Former East Bloc (FEB) countries								
Czech Republic	79	10,295	0.0	130.3	U	65	36,024	U
Hungary	93	10,161	–0.4	109.3	49	64	41,374	2.2
Poland	313	38,341	0.3	122.5	52	64	92,580	U
Russian Federation	17,705	148,366	0.5	8.4	U	73	376,555	U
Non-OECD countries								
Brazil	8,512	159,100	1.8	18.7	66	77	554,587	4.8
China	9,561	1,190,918	1.4	124.6	18	29	522,172	8.7
India	3,288	913,600	2.0	277.9	20	27	293,606	4.5

[1] GDP components are calculated at purchaser values for the United States, Australia, Canada, France, Italy, Japan, Mexico, the Czech Republic, Hungary, and China.
[2] Base year is 1970.

KEY: U = data were unavailable.

SOURCES:
World Bank. 1994. *World Development Report 1994: Infrastructure for Development.* New York, NY: Oxford University Press.
____. 1995. *World Development Report 1995: Workers in an Integrated World.* New York, NY: Oxford University Press.
____. 1996. *World Atlas 1996.* Washington, DC: International Bank for Reconstruction and Development.
____. 1996. *World Development Report 1996: From Plan to Market.* New York, NY: Oxford University Press.
Organization for Economic Cooperation and Development. 1996. *OECD in Figures: Statistics on the Member Countries.* Paris, France: OECD Publications Service.

Aeroflot, the Russian airline. While many transit systems are heavily subsidized, Singapore's is profitable. Other government policies, such as economic restructuring in the FEB, also affect passenger travel and freight activity.

Geographic conditions influence transportation structure. For example, the population of Japan is heavily concentrated in one linear corridor (Tokyo to Osaka), which helps to explain the continuing popularity of rail services in Japan,

despite large increases in automobile ownership. The linear corridor effect similarly contributes to the viability of train service in the Northeast Corridor of the United States, between Washington, DC, New York City, and Boston.

Freight Activity

A nation's economic health affects the level and composition of its freight transportation. Rapid economic development in countries such as China and India has contributed to rising levels of freight activity. In contrast, the stagnant economies of many FEB countries meant slow growth rates or declines in freight activity in the late 1980s and early 1990s.

Sectoral economic changes also influence freight activity. In most OECD countries, manufacturing and services, rather than agriculture or mining, are the dominant economic sectors. Consequently, manufactured goods, often of lower weight and higher value than traditional primary commodities, account for an increasing proportion of goods transported, stimulating a shift from rail to road and air transportation. Expanding non-OECD countries are undergoing economic changes, often at a more rapid pace than OECD countries. Development strategies in countries such as India, China, and the FEB countries have focused on shifting from the processing of raw materials to the production of semiprocessed or complete, higher value, and lighter density goods. Changes in transportation demand and services can be expected to follow.

Business production changes in recent decades have impacted freight transportation, especially in OECD countries. These changes include just-in-time delivery and product customization. As discussed in chapter 9, shippers increasingly insist on transportation speed, efficiency, and flexibility in meeting their needs. In this new environment, logistics management is a critical component of freight transportation. Usually, road transportation offers the most flexibility in responding to these changes.

New technology influences freight activities. Intelligent transportation systems and electronic data interchange provide better information on routing, traffic conditions, and potential trouble spots.

Government policies and regulations have both direct and indirect impacts on the provision of and demand for freight networks and services. State-owned or regulated freight transport was common in many OECD and FEB countries. In the past 10 to 15 years, countries as diverse as the United Kingdom, Mexico, and Poland have privatized state-owned or controlled entities and deregulated many transportation sectors. Often, road transportation was one of the first sectors to be deregulated.

Regional trade agreements like the North American Free Trade Agreement (NAFTA)[8] and common markets such as the European Union[9] influence the level and nature of freight activity within countries. Such agreements can be expected to increase international trade between member countries through reductions in tariffs and other trade restrictions, including restrictions on transportation. As international commerce grows, the level of domestic freight activity within member countries may also rise.

[8] NAFTA, which became effective on January 1, 1994, established a free trade area between the United States, Canada, and Mexico.

[9] In 1997, the 15 member countries of the European Union are: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden and the United Kingdom.

Trends by Region: Passenger Mobility

OECD Countries

This section reviews passenger mobility in OECD countries—Western Europe, Japan, Canada, and Mexico, but not the United States, which is covered in chapters 6 and 7.

► Western Europe

Surface passenger mobility increased an average of 3 percent annually in Western Europe[10] between 1970 and 1990—from about 2,100 billion pkt (1,300 billion pmt) to approximately 3,900 billion pkt (2,400 billion pmt). Modal shares shifted toward automobiles and airplanes away from railroads and buses. There are still marked differences, however, in car ownership rates among Western European countries (see table 10-5). During the 1980s, air travel grew faster (at 6 percent annually) than travel by passenger car (3.3 percent). (Banister and Berechman 1993)

For urban travel, the distance traveled increased by more than 50 percent, but the amount of time spent traveling (about one hour per day) and the average number of short journeys (three per day) remained constant. (ECMT 1996a)

[10] Three ways to characterize "Europe" for transport purposes are as OECD Europe, the European Union, and the European Conference of Ministers of Transport (ECMT). In general, the discussions here refer to OECD or ECMT Europe. See footnote 1 for a list of OECD countries. Members of the ECMT include: *Austria, Belgium*, Bosnia-Herzegovina, Bulgaria, Croatia, the Czech Republic, *Denmark*, Estonia, *Finland, France, Germany, Greece,* Hungary, *Ireland, Italy,* Latvia, Lithuania, *Luxembourg,* Moldova, *the Netherlands, Norway,* Poland, *Portugal,* Romania, the Slovak Republic, Slovenia, *Spain, Sweden, Switzerland,* Turkey, and the *United Kingdom*. The countries in italics are referred to here as "Western Europe."

Table 10-5.

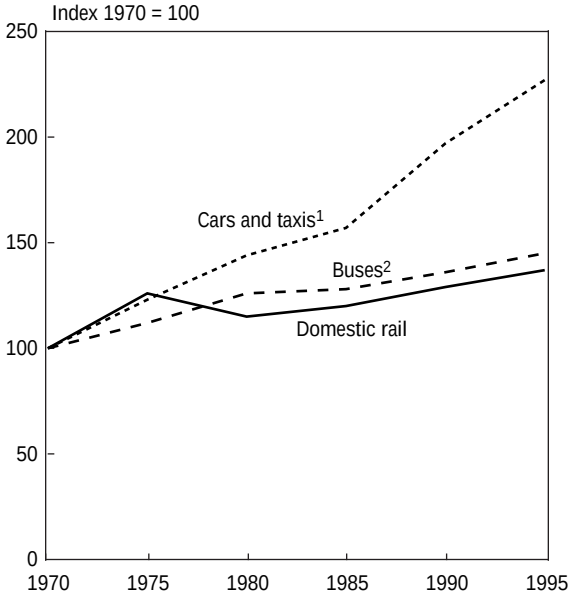
Passenger Cars per Capita and Density, Selected Countries: 1994

Country	Cars[1] per 1,000 inhabitants	Cars per square kilometer
OECD countries		
United States		
Cars, taxis, and light trucks	727	20
Cars and taxis	514	14
Canada	487	1
Mexico	92	4
France	430	45
Germany	492	112
Denmark	312	38
Italy	513	99
Turkey	46	10
United Kingdom	410	97
Australia	470	1
Japan	341	113
FEB countries		
Hungary	203	22
Russia	46	1
Non-OECD		
India	4	1
China	3	<1
Hong Kong	48	280
Thailand	18	2
Peru	20	<1
Brazil	76	1
Nigeria	8	1
South Africa	84	3

[1] The types of motor vehicles that countries include in their passenger car statistics can vary, and may not refer to the same types of vehicles that the United States includes in its totals (i.e., light trucks). See footnote 4 in the text for more details.

SOURCES:
For United States: U.S. Department of Transportation, Federal Highway Administration. Various years. *Highway Statistics.* Washington, DC.
For other countries: American Automobile Manufacturers Association. *World Motor Vehicle Data, 1996 Edition.* Detroit, MI.

Figure 10-3.
Western European Passenger Transport Trends for Selected Modes



[1] Car and taxi totals typically include passenger cars (i.e., rental cars, taxis, jeeps, estate cars/station wagons, and similar light, dual-purpose vehicles) seating not more than 9 persons (including driver).
[2] Includes coaches, buses, and trolleybuses.

NOTE: Includes Austria, Belgium, Denmark, France, Germany, Greece, Italy, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the United Kingdom.

SOURCE: Based on data supplied to the Bureau of Transportation Statistics by the European Conference of Ministers of Transport, Paris, France.

As shown in figure 10-3, passenger car pkt increased faster than that of rail and buses between 1970 and 1990. Despite their slower growth rate, buses and trains remain important forms of local and regional transportation in all Western European countries. Within urban areas, buses are the dominant public transit mode, but trams prevail in some medium-sized and large cities. In addition, many large cities—among them, London and Paris—have underground transit systems. At 424 billion pkt (263 billion pmt) in 1990, buses accounted for more European travel than did trains. (ECMT 1995c)

The importance of air transportation varies widely among European countries for economic and geographic reasons. Short intra-country distances mean air travel is primarily international. Even then, surface travel is favored between adjacent European countries. For international trips, the people of the United Kingdom, Ireland, Greece, and Finland are more likely to use air than surface travel, mainly because of geography.

Air transportation has been highly regulated in Europe. Reliance on national flag carriers has meant little domestic and reduced international competition, with market capacity and fares predetermined among airlines and governments. Bilateral deregulation began in 1984 between Britain and the Netherlands, and gradual deregulation under European Commission directives has been underway across Europe; the last phase began in 1997. Lower airline costs and fares are expected for scheduled services. While the fares of European scheduled carriers have been among the highest in the world, average passenger costs have been lower because charters have held a large market share. (Banister and Berechman 1993, 91) With fares about one-third those of scheduled carriers in the mid-1980s, charters annually carried 78 percent of the nearly 19 million people who flew from Britain to Spain, Portugal, Italy, and Greece.

European governments, individually and collectively through the EU, acknowledge the congestion and environmental problems resulting from the growing dominance of the private automobile. Many have used regulations, traffic management, and economic measures to hold down auto growth and modal share. Measures include vehicle taxes, fuel taxes, automobile exclusion zones in urban areas, and special road tolls during peak periods. France, for example, has raised tolls on motorways leading into Paris during the Sunday afternoon peak, as people return from weekend excursions. This has resulted in a more even traffic flow spread out during the day. Zurich has parking constraints and traffic controls to limit vehicle entry when an auto-

Box 10-2.

Bicycle Use and Transportation Policies in Selected Countries

Despite the increase in motorization worldwide, bicycles continue to be used for personal mobility, although their importance varies by country. In fact, bicycling is a component of national transportation policies in several countries. In some developed countries, ways are sought to encourage and facilitate switching from cars to bicycles, especially for short journeys, and improve the safety of cycling. In developing countries that are rapidly motorizing, the focus is on reducing the conflict between bicycles and cars.

The Netherlands

Bicycle use in the Netherlands declined during the late 1960s and early 1970s. In recent decades, the Dutch have made bicycling an important part of their transportation policy, linked to securing a sustainable society. The policy is based on the view that the bicycle is an alternative to the car. The relatively short distance of Dutch daily trips helps increase the viability of bicycling as an alternative mode. In the early 1990s, 20 percent of all car trips were shorter than 2.5 kilometers (1.5 miles) and 54 percent were shorter than 7.5 kilometers (4.5 miles). In towns and cities, trips longer than 7.5 kilometers are rare.

Auto traffic in cities, however, can make cycling unattractive and hazardous. Despite efforts to build cycling routes and special crossings, tunnels, and bridges, the total distance traveled by bicycles between 1992 and 1994 increased less than 1 percent, while car-kilometers traveled increased 3 percent. Despite a slight national decline, bicycle use in several Dutch cities is significant. In Groningen, for instance, two-thirds of all trip lengths are no greater than 5 kilometers (3 miles) and 76 percent are on foot or by bicycle. Dutch policies directed at increasing the use of bicycles include banning automobiles from inner-city cores, improving safety, protecting bicycles against theft, and improving trip-chaining opportunities.

China

Prior to 1979, the Chinese government rationed bicycles. They were viewed as high-status consumer goods, and only one person in four or five had a bicycle. As part of economic reforms begun in 1979, the government ended bicycle rationing, instituted employer-based bicycle subsidies, and set aside one-third of the road space for bicycles. In response, bicycle production, density, and usage rose. In 1990, China produced approximately 40 million bicycles, nearly 40 percent of global production and four times its 1980 production levels.

In Shanghai in 1990, there was one bicycle for every 2.2 inhabitants, one of the highest densities in the world. Due to the increased use of bicycles, the national government as well as many individual Chinese cities are reviewing policy options for new kinds of transportation concerns such as growing bicycle congestion and parking problems. In addition, due to the growth of motorization in China, mixed traffic problems (where nonmotorized and motorized modes share the road) are rising.

United Kingdom

Currently, 72 percent of all passenger trips in Britain are less than 5 miles in length, and half are less than 2 miles. In 1996, the Department of Transport issued a national cycling strategy stating that the bicycle had been underrated and underused and should be a part of the country's sustainable transport policies. The strategy is designed to double bicycle use by 2002 (over 1996) and double it again by 2012, both by capturing short journeys and by combining bicycle trips with public transportation for longer journeys. Various mechanisms have been identified to meet the increased-use objective, as well as other complementary objectives such as improving safety, reallocating road space for cycling, creating bicycle parking facilities, developing standards for cycle security devices, and initiating various promotional activities. Most action will take place at the local level. The Minister for Local Transport has established a National Cycling Forum to coordinate action, involve key players, and report on progress.

Box 10-2.

Bicycle Use and Transportation Policies in Selected Countries *(continued)*

Peru

Bicycles are being promoted as an alternative mode of passenger transportation in Peru, where public transportation is often erratic or too expensive for many lower income citizens. This promotion is most evident in the capital city of Lima, where the national and local governments, in conjunction with the World Bank, established a pilot program in 1992 with the goal of increasing bicycle use from 2 percent to 10 percent of all trips. The project is estimated to cost $4.1 million, mostly for the construction of bikeways that link Lima's low-income areas with the city's urban center. Construction of 51 kilometers (32 miles) of dedicated bicycle lanes and 35 kilometers (22 miles) of bike paths on reconditioned roads is nearing completion. The project also established a credit facility to give out $100 loans, repayable over a 12-month period, for the purchase of a bicycle by those who live in the area of the bicycle network and who have annual incomes under $1,800.

Finland

Finnish policy aims to make cycling a distinctive part of traffic policy, to double bicycle trips from 12 percent in 1986 to 25 percent in 2000, and to cut the number of fatal accidents in half. Finland estimated that doubling bicycle use would generate "socioeconomic savings" of approximately ECU100 million to 200 million (US$125 million to $250 million) per year. A 1995 review of the status of the policy found the initial timetable to be too ambitious, but a national bike touring network of 22,000 kilometers (13,670 miles) was created, and the program has raised cycling's status. Finnish cycling interests are now working to obtain more national resources to support the program and encourage local initiatives.

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T. Welleman, Dutch Ministry of Transport, Public Work, and Management. 1995. The Autumn of the Bicycle Master Plan: After the Plan, the Products, in *Proceedings of the Velo-City Conference*, Basel, Switzerland, 20–26 September.

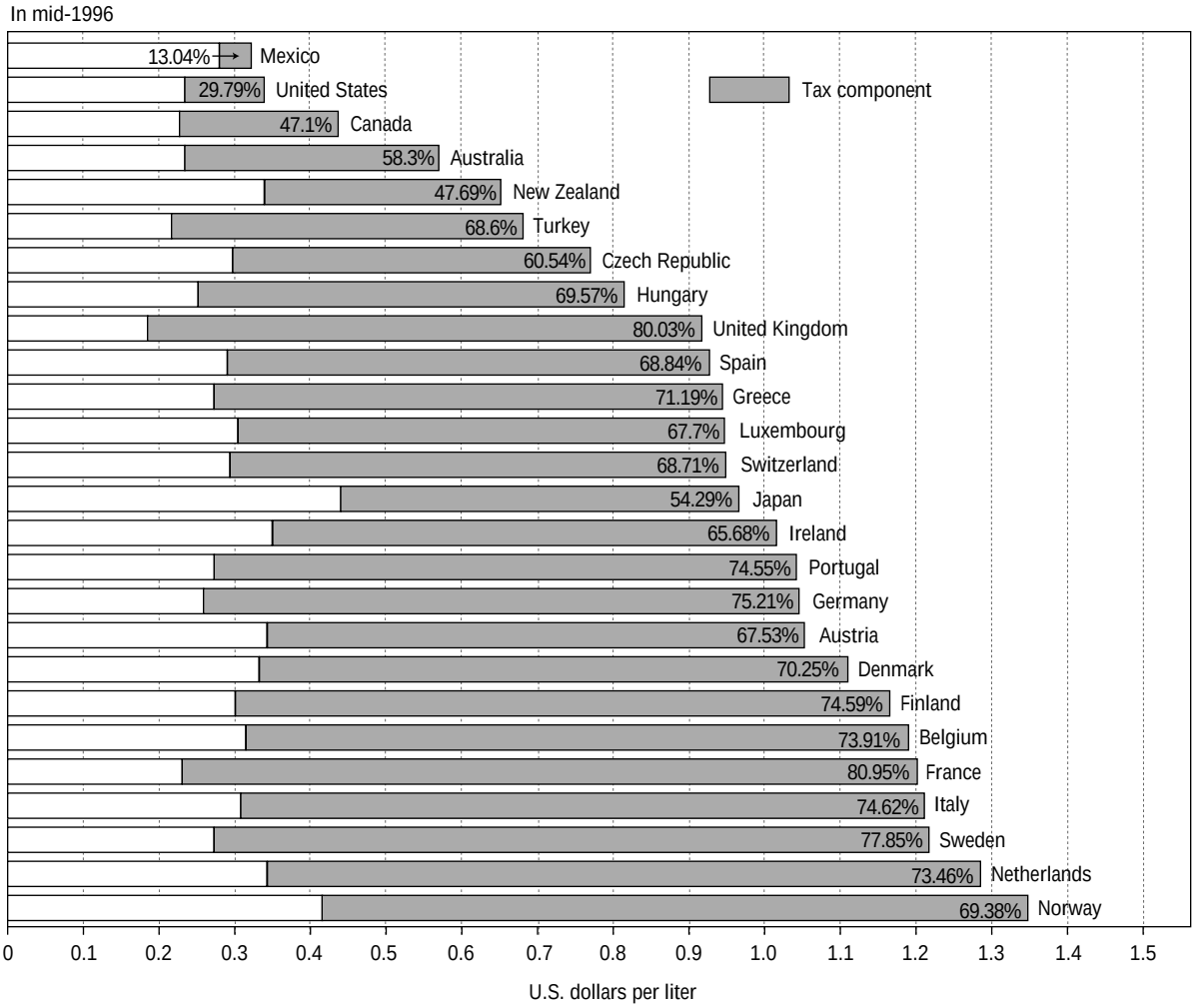
matic monitoring system indicates that congestion levels are too high. Other European measures include improving and expanding public transit services and, in some countries, encouraging bicycle use (see box 10-2).

While many of these policies have been used in the United States, most have been applied more aggressively in Europe. Pedestrian-only zones are common in old, historic sections of European cities, and may be more applicable in those cities with their narrow streets than in American cities. Europeans are also more tolerant of high gasoline taxes and automobile fees. The average price of gasoline ranged from 90¢ to almost $1.40 per liter ($3.41 to $5.30 per gallon) in Western Europe and just over 30¢ per liter ($1.14 per gallon) in the United States in mid-1996.[11] Figure 10-4 illustrates that the price difference is primarily due to taxes, which can be more than four times greater than the price of gasoline in Europe.

European research suggests that policies aimed at reducing automobile use may have had only limited impact. The reasons include: 1) the cost of buying and maintaining a car and purchasing gasoline has declined over the last 20

[11] Converted at 3.785 liters per gallon.

Figure 10-4.
OECD Gasoline Prices and Taxes



SOURCE: International Energy Agency. 1996. *Energy Prices and Taxes, 2nd Quarter 1996.* Paris, France: Organization for Economic Cooperation and Development.

years, while public transit costs have risen; 2) high fuel taxes seem to have caused people to switch to more fuel-efficient cars rather than from car to transit; and 3) improvements in bus service have been too modest to stimulate much added demand. (Salomon et al 1993) One policy that seems to have had some success is high taxes on automobiles. Denmark has the highest automobile tax and the lowest per capita ownership in Northern Europe. Cars are taxed twice: when initially registered (at 125 to 180 percent of the purchase price) and annually thereafter (based on the weight of the vehicle). A recent study concludes that no single measure—improving alternatives, awareness campaigns, parking fees, taxes, or urban planning—is successful if used in isolation. (ECMT 1996a)

Government policies in Europe have long affected rail usage. European railroads were originally built by entrepreneurs, as they were in

the United States. As their dominant role in transportation gave way to roads, governments nationalized and subsidized rail networks, in part to preserve service. (ECMT 1995f) Today, subsidized European rail is confronted with economic, structural, and cultural changes, and European governments are again attempting to revive their railroads. (EC 1996) Returning rail operation to the private sector, as the United Kingdom, Germany, and the Netherlands are doing, is one option. In another effort to expand the role of railroads, Europe has been extending its network of high-speed trains (see box 10-3).

► Japan

As in Europe and the United States, automobile and air travel are increasing in Japan. In contrast, travel by bus and rail is growing much more slowly. Automobile use has grown 12 percent annually since 1960 while rail use grew 5.7 percent per year. (Japan Ministry of Transport 1996) Figure 10-1 shows modal shares for selected years.

The first Japanese expressway was completed in 1969. During the next two decades, the Japanese built roads, added passenger cars, and increased their driving at annual rates exceeding those in the United States (see figure 10-2). Today, 80 percent of Japanese households have at least one passenger car, up from 67 percent a decade ago.

Japanese commuters face particularly heavy congestion along expressways and arterial roads as they travel in Tokyo and its suburbs. The median commute time for Tokyo is 43.5 minutes, compared with the national median of 27.3 minutes. (Statistics Bureau 1983–93) The government has attempted to address congestion by adding roadways, a policy that may help to explain the small change in median commute times between 1983 and 1993.

Despite its slower growth rate, rail is still an extremely important mode of passenger transportation. In Japan, passenger rail has a higher modal share than in any other developed country, and rail pkt per capita are much higher in Japan than elsewhere in the world (see table 10-6). While rail travel commands a 35 percent modal share nationally, it is concentrated in the Tokyo-Osaka corridor, which is home to almost half of all Japanese. In Nagoya, outside this corridor, rail captures only about 10 percent of personal travel and in Kumamoto, less than 1 percent.

Rail and intercity and urban bus travel have suffered from competition with passenger cars. Most trams disappeared from Japanese cities in the 1960s, city buses felt the effects in the early 1970s, and in the late 1970s railways lost passengers. In 1987, because of continuing losses, Japan National Railway was privatized and broken up into six regional lines. The intercity market has grown with improved services, cost reductions, and lower fares (in real terms). Provincial railways, however, still depend on national and provincial subsidies. Hanging over the entire rail system is a $250 billion debt accumulated during its nationalization period, for which the government has yet to devise an acceptable repayment plan.

Air transportation has become increasingly important. From 1970 to 1990, domestic pkt grew 9 percent per year, gaining a 5 percent modal share. (Japan Ministry of Transport 1996) At about 490 pkt (304 pmt) per capita in 1994, Japanese travel domestically by air considerably less, on average, than Americans, who log approximately 2,400 pkt (1,500 pmt) per capita.

► Canada

Just as people in the United States, Europe, and Japan rely more on passenger cars for travel, Canadians also appear to do so. Unfortunately,

Box 10-3.

High-Speed Rail: International Perspectives

High-speed rail (HSR) systems link metropolitan areas that are 100 to 500 miles apart with operational speeds in excess of 124 miles per hour (mph) or 200 kilometers per hour.[1] HSR technologies fall into three broad groups, in order of increasing performance capabilities and initial infrastructure cost: 1) accelerated rail service, with operational speeds of 120 to 150 mph, consisting of upgraded intercity rail passenger service on existing railroad rights-of-way; 2) advanced steel-wheel-on-rail passenger systems on new rights-of-way that can attain operational speeds on the order of 200 mph; and 3) magnetic levitation (maglev) systems that employ magnetic forces to lift, propel, and guide a vehicle over a specially designed guideway, eliminating wheels and many other mechanical parts, minimizing resistance, and permitting faster acceleration, with cruising speeds expected to be 300 mph or higher.

The world's first HSR system—Japan's Bullet Train (or Shinkansen)—started running between Tokyo and Osaka in 1964. France became the second nation with HSR service when its TGV (Train à Grande Vitesse) Paris/Lyon line opened in 1983. Germany and Spain initiated HSR service in 1991 and 1992, respectively. Systems in Taiwan and South Korea are under development. Amtrak's Metroliner started HSR service in the United States in 1986[2] between New York and Washington. Amtrak's *American Flyer* service, will further improve on current performance speeds throughout the Northeast Corridor (Washington to Boston) when it begins operations in late 1999.[3]

Japan and Germany are developing maglev technologies and systems. Japan plans to test a commercial line in 1997, with a maximum speed of 342 mph. Germany's maglev system is technically different from Japan's and is targeted for operation between Hamburg and Berlin by 2010. Technical, route, and financing issues must still be resolved, however.

HSR can be competitive with automobiles and air travel if it offers comparable travel time and frequent and reliable service. Four years after the Paris/Lyon TGV route opened, rail passenger trips increased 90 percent for personal travel and 180 percent for business travel. Both increases came at the expense of air and automobile travel. France now has a national network of TGV service.

In 1994, France and the United Kingdom initiated London to Paris HSR service using the privately constructed and operated channel tunnel, or chunnel. Passenger and freight services are provided by the national railways of France, the United Kingdom, and Belgium. Le Shuttle carries freight trucks, buses, and passenger cars and their drivers between coastal points. A passenger line, the Eurostar, directly links London and Paris or Brussels. Surface travel time for the London to Paris route is four hours less than the traditional train and ferry journey. The trip is now 3 hours long, but will take 2½ hours when the high-speed tracks are completed on the U.K. side of the Eurostar route. British Airways reported a loss of 30 to 40 percent of its passengers on its competing one-hour London to Paris flight. P&O European Ferries carried 23 percent fewer passengers and 17 percent fewer vehicles during the first quarter of 1996.

The chunnel operation has not been smooth, however. Despite soaring revenues in 1995, its first full year of operation, losses increased so much that Eurotunnel (the management consortia for the chunnel) defaulted on interest payments and had to renegotiate its financing. Then, a fire in November 1996 on a Le Shuttle train carrying trucks severely damaged part of the tunnel. After two weeks, slightly reduced schedules for all other services resumed. Freight truck service, however, may not be resumed until late 1997. Despite these problems, usage increased. The number of Eurostar passengers increased 29 percent and freight tonnage was up 11 percent in March 1997 compared with March 1996. Passenger vehicles carried on Le Shuttle, however, declined 2 percent and buses carried declined 27 percent.

In the United States, various HSR options are being considered for passenger transportation in several corridors. (See figure 8-2 in chapter 8 for some locations under consideration.)

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[1] 100 miles per hour equals 161 kilometers per hour.

[2] Initial Metroliner operating speeds were 110 mph in 1969. These were increased to 125 mph (the HSR threshold) in 1986.

[3] These Amtrak improvements are dependent on $3 billion in additional expenditures by the federal government and Amtrak. (USGAO 1997)

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Table 10-6.
Passenger Rail Travel in Selected Countries

Country	Passenger-kilometers traveled per capita
Japan (1990)	3,134
Hungary (1992)	850
Bulgaria (1991)	541
India (1991)	370
Argentina (1991)	332
South Africa (1992)	286
China (1991)	252
United States[1] (1990)	163
Chile (1991)	86
Mexico (1991)	44
Nigeria (1991)	12

[1] U.S. passenger rail total includes Amtrak, commuter rail, light rail, and heavy rail.

SOURCES:
Japan Ministry of Transport, Transport Policy Bureau Branch, Information Research Department. 1996. *National Transportation Statistics Handbook 1995.* Tokyo, Japan. 15 February.
U.S. Department of Transportation, Bureau of Transportation Statistics. 1996. *National Transportation Statistics 1997.* Washington, DC. December.
World Bank. 1994. *The Evolution of the World Bank's Railway Lending.* Washington, DC.

Canada does not regularly collect modal share data and, when it does, the data cover only intercity travel.[12] Comparisons with other countries are also difficult because data for passenger car use are often expressed in person-trips rather than pkt. Regular trend data in pkt are available for intercity travel by bus and rail.

Data show that, for intercity travel, automobile and domestic air use increased from 1984 to 1994, while bus and rail declined. (Statistics Canada 1995) Statistics Canada concluded in 1988 that the private automobile was the dominant form of transportation for short and mid-length trips (under 800 kilometers or 497 miles), while commercial aviation nearly monopolized longer distance trips. (Statistics Canada 1988) In 1994, automobiles held 93 percent of all intercity person-trips, up from 89 percent in 1982. (Statistics Canada 1995)

The history of Canadian and American intercity passenger rail service is similar. While rail in both countries now has only about a 1 percent passenger modal share, rail was instrumental in the development of the western areas of both countries in the 1800s and dominated passenger mobility until the mid-1940s. As automobiles gained popularity, both national governments created quasi-public corporations to preserve what remained of passenger rail service. In the United States, this occurred in 1971 with the formation of Amtrak. The Canadian government created VIA Rail Canada in 1977. VIA Rail took over stations, maintenance operations, and equipment from the government-owned Canadian National Railway[13] and the private sector Canadian Pacific Railway. Concern about rising government subsidies led to organizational restructuring and reduction in some VIA Rail service routes. With 18 of 38 routes eliminated, intercity rail pkt dropped 46 percent to 1,392 million in 1990. Through 1994, intercity rail and bus growth was negligible. This suggests that Canadians substituted passenger car travel for at least some of the missing rail service. As this was a recessionary period in Canada, overall intercity travel may have been down as well.

Air transportation is important to Canadian mobility, particularly for long-distance travel. A February 24, 1995, U.S./Canadian open skies agreement provided increased opportunity for Canadian and American transborder passenger travel. Under the agreement, Canadian carriers gained unlimited route rights to any point in the United States, while U.S. carriers gained unlimited route rights to any point in Canada except

[12] Intercity travel is defined by Statistics Canada as one-way trips greater than 80 kilometer (about 50 miles).

[13] Canadian National Railway was subsequently privatized in 1995.

Toronto, Montreal, and Vancouver. Route rights to these three cities will be phased in over a three-year period. Since the agreement, more than 100 new scheduled connections have been established between Canadian and U.S. cities. (Transport Canada 1996b)

► Mexico

Passenger travel more than doubled in Mexico between 1980 and 1993. Road transportation, including passenger cars and buses, grew 6 percent annually, air travel rose 3.9 percent per year, while rail pkt declined 3.8 percent annually. By 1993, road transportation held 95 percent of domestic pkt, air travel 4 percent, and rail 1 percent. (SCT/IMT 1995)

Mexican statistics do not show a breakdown among road passenger modes, thus the relative importance of passenger cars and buses is not known nor is it known which contributed more to road transportation growth. OECD data show Mexican passenger car ownership growing at an annual rate of 5 percent (1980 to 1992), more than twice that in the United States. Still, by 1994, Mexico had only 92 passenger cars per 1,000 persons (see table 10-5). This suggests that buses are a major source of mobility in Mexico.

Former East Bloc Countries

Following the fall of the Berlin Wall in 1989 and the collapse of communism, FEB countries experienced serious structural economic adjustments, compounding the macroeconomic difficulties they had already faced in the 1980s. Despite economic downturns, people in the FEB have been switching to cars at the expense of public transport, which historically has been the backbone of the region's urban mobility.

Motorization in the FEB generally lags Western Europe by two or more decades. A modal share estimate for Eastern Europe in the early 1990s showed passenger cars at 10 to 20 percent, public transportation at 50 to 60 percent, and modes such as walking and bicycling at 30 to 50 percent. (Salomon et al 1993, 19) Growth in automobile usage is concentrated in urban areas. In some cities—notably Warsaw and Budapest—automobile ownership, but not use, has reached levels comparable to some Western European cities. Poland, for example, had only 170 cars per 1,000 inhabitants in 1992, but the rate for Warsaw, its largest city, was 322. (ECMT 1996b, 150) Bicycle use in FEB countries is low compared with some Western European countries, although walking seems to claim a higher proportion of journeys. (OECD/IEA 1995)

The two major factors influencing passenger modal shifts in FEB countries are the transition to market economies and a decline in government support for public transportation. From 1970 to 1990, annual growth in automobile ownership in Hungary, Poland, and Czechoslovakia[14] was 9, 13, and 22 percent, respectively. These rates are more than twice those in most of the OECD countries. The cost of acquiring a car in the FEB has been lowered by the importation of old, used automobiles from Western Europe, and from Japan to eastern Russia, but purchase and ownership costs are still high relative to incomes. The price of gasoline in the Czech Republic and Hungary is more than double the price in the United States (see figure 10-4), but per capita income is 85 percent lower. This disparity has most likely held down demand for and use of cars, and slowed the decline in transit even though its price has risen in real terms since 1989. (OECD/IEA 1995)

[14] On January 1, 1993, Czechoslovakia divided into the two separate, independent nations of Slovakia and the Czech Republic.

In Poland, prior to the 1990s, state-owned companies running trams, buses, and commuter rail carried 80 to 90 percent of nonpedestrian trips in main cities, but recovered only about 20 to 30 percent of their costs in fares. Now, with municipalities responsible for public transportation and central government subsidies declining, fares have increased. This, combined with the shift to passenger cars and high unemployment rates, meant a 7 percent annual decline in transit usage from the mid-1980s to 1993. Impacts include rapidly growing traffic congestion, parking problems, road surface deterioration, and increases in air pollution and noise in urban areas. (ECMT 1996b) For those with passenger cars in Poland, though, mobility increased 11 percent annually, as measured in vkt, from 1980 to 1992. Meanwhile, national rail pkt rose only 1 percent annually. (ECMT 1995c) Automobile use may be further encouraged, given the Polish government's decision in 1993 to construct 2,000 kilometers of motorways (a 6 percent increase over 1990) within 15 years. (IEA 1994b)

Private transportation is still a luxury good in countries of the former Soviet Union (FSU). The International Energy Agency (IEA) estimated that the Baltic States (Estonia, Latvia, and Lithuania) had the highest automobile ownership rates (about 150 per 1,000 in 1993). Growth in automobile ownership and use throughout the FSU will be constrained by the poor condition of roads and their limited extent. Total motorway length in the whole region is half that of Italy. (IEA 1996a)

In Russia's cities, public transportation (primarily buses) had an 85 percent modal share in 1991. With declining government subsidies, the physical condition of Russia's public transportation system is deteriorating. (World Bank 1993b) At the same time, ridership is declining as fares increase and service decreases. Few buses are being purchased, because of the lack of capital and foreign exchange. In addition, as buses get older, they often cannot be repaired because of the lack of spare parts.

Air transportation in Russia carries a high proportion of intercity travel. Russians have traditionally depended on airline travel because of the vast distances between cities, low fares, and the relative scarcity of intercity bus and automobile transportation. This situation is changing, however. In January 1993, the central government dropped passenger service subsidies; at the same time, energy costs began to increase. As fares have risen, demand for air transportation in Russia has decreased. Between 1992 and 1994, demand fell 57 percent. The decline may be a short-term effect, while the air transportation system adjusts to a market economy, but demand is not expected to reach 1990 levels for decades. (World Bank 1993b)

There is growth in the number of airlines, however, with 174 airlines registered for service in mid-1993. These new carriers supplement Aeroflot, which was controlled by the FSU central government but has now been divided among the former republics. It is unlikely that all of the carriers will survive over the long term. Aeroflot service in Russia has been beset by wholesale cancellation of flights because of drastic drops in demand and fuel disruptions.

Other Non-OECD Countries

Passenger travel trends vary greatly among developing countries. In some countries, such as China, India, and Brazil, passenger travel has rapidly expanded. In others, particularly many countries in Africa, growth in passenger transport has stagnated or declined. Economic, institutional, and political factors, in addition to the level and condition of infrastructure account for these differences.

Inadequate transportation infrastructure is evident in many developing countries. This

affects both current levels and future expansion of passenger and freight traffic. Rail networks often cannot handle the demands of increasing volume, and road networks in many cases are poorly developed or maintained. Financing new transportation infrastructure and services, and finding the money to maintain what already exists, are challenges for most developing countries. Seventy percent of World Bank road funds now support maintenance and rehabilitation rather than new construction. (World Bank 1996)

Three interconnected themes define the growth of passenger mobility in developing countries. The first is increased passenger travel. The second is an ongoing shift from nonmotorized to motorized modes of transportation. The third is an emerging role for air passenger travel in countries with rapidly expanding economies.

Available data for developing countries show pkt growing much faster than population, and at rates higher than those in OECD countries. In China, pkt for all modes grew an average of 9.7 percent annually between 1982 and 1992. (Chinese Ministry of Communications 1992) In Brazil, pkt grew 3.6 percent per year between 1990 and 1994. (Ministerio dos Transportes 1995) In India, pkt in 1992 was over five times what it was in 1951, growing from 232 billion pkt (144 billion pmt) to 1,200 billion pkt (746 billion pmt). (World Bank 1996)

People in developing countries increasingly rely on private automobiles. Today, there is an average of only 20 cars per 1,000 people in developing countries compared with an OECD average of 382. From 1970 to 1993, however, the number of passenger vehicles in use grew more rapidly in developing countries (at 6.4 percent per year) than in OECD countries (3.5 percent), increasing non-OECD countries' share of the world's passenger cars from 11 percent to 19 percent. Large differences in cars per capita remain among countries, but the potential for continued growth is high in all of these countries (see table 10-5). As the number of motor vehicles in developing countries multiplies, their concentration in urban areas increases. Half of the automobiles in Iran and Thailand are in the capital cities.

Data also show that road transportation's modal share is increasing. In China, for example, as road transportation (including automobiles, buses, and taxis) grew 12.7 percent per year between 1982 and 1992, rail grew 7.2 percent. (Chinese Ministry of Communications 1992) Since 1990, road transportation pkt in China has been slightly higher than the once dominant rail. Road transportation, including passenger cars, taxis, motorcycles, and buses, accounted for 96 percent of pkt in Brazil in 1994. In some parts of Asia, motorcycles account for up to three-quarters of motorized passenger vehicles.

Despite relatively rapid growth in automobile use, people in developing countries still rely heavily on public and nonmotorized transportation, including foot travel. The balance between modes depends heavily on incomes. In Sub-Saharan Africa, much rural and urban travel is on foot. In Delhi, India, in 1992, 65 percent of the poorest residents walked to work, while only 10 percent of low-income and 3 percent of middle-income residents commuted on foot. The informal sector—operating jitneys, minibuses, and rickshas—is an important supplier of public transportation in many cities in Africa, parts of Asia, and Latin America. (World Bank 1996)

Nonmotorized vehicles (NMVs), such as bicycles and cycle rickshas, are particularly important in Asian countries. Because of urban congestion in many developing country cities, NMVs may provide greater mobility than other forms of transport. In the early 1990s, bicycles accounted for 50 to 80 percent of urban vehicle trips in China, with average journey times com-

parable to those in more motorized Asian cities (see box 10-2). (Replogle 1994) In India, there are roughly 25 times as many bicycles as motor vehicles, and in cities they account for 10 to 30 percent of all person-trips. Despite many positive attributes, however, such as low environmental damage, speed, and affordability, the modal share of NMVs has been falling in many developing countries with shifts to motorized transport.

Nonmotorized and motorized vehicles often exist uneasily side by side in urban areas, especially in cities where traffic discipline is lax. Some nations (such as Indonesia and Bangladesh) set policies to discourage NMVs. In Indonesia, for example, cycle rickshas have been suppressed through bans, taxes, licensing requirements, and confiscation. Other countries have tried to establish systems that enable the two transportation systems to coexist. In Chinese cities, motor vehicles and NMVs are increasingly separated at intersections by fences, and dedicated bicycle roadways (e.g., alleys) are being considered. Chinese cities have also been establishing bicycle-subway and bicycle-bus exchange hubs. Some Indian railway stations provide parking areas for thousands of bicycles. (See box 10-2 for further discussion of bicycle use in China and Peru.)

Railroads are particularly important to personal mobility in parts of Asia. Chinese and Indian railways each carry more passenger traffic than all Western European and U.S. railroads combined. (World Bank 1994b) In India, per capita pkt on rail is more than twice as high as in the United States (see table 10-6).

Air transportation is becoming more important in non-OECD countries. The geography of some countries, such as Peru and Nepal, has long made air transportation essential. In general, however, in the developing world, air transportation is still used more for business travel than for personal transport. Nevertheless, in some countries the air passenger market is expanding more quickly than other modes and more rapidly than in OECD countries. In East Asia, air pkt grew 9 percent annually from 1980 to 1990, faster than in other developing country regions. South Asia was second at 5.8 percent, while air travel in Latin America and Africa grew at annual rates of 3.7 and 2.4 percent, respectively, during this period.[15] In Latin America, in particular, air traffic growth is being stimulated by new alliances between U.S. carriers and newly privatized carriers in Brazil, Colombia, and other countries in the Americas. (Zellner and Mondel-Campbell 1997)

Increasing population, urbanization, and per capita income in non-OECD countries have affected demand for and the nature of passenger transportation. While population in OECD countries grew at less than 1 percent per year in the 1980s, the population of the rest of the world grew 1.9 percent annually. In many developing countries, the rate was significantly higher. Strong economic growth contributes to rising per capita income and the development of dynamic middle classes in many non-OECD countries. While the U.S. real average annual growth rate in gross domestic product per capita was 2.8 percent from 1970 to 1994, the rates for Brazil and India were greater while China was nearly three times as high (see table 10-4).

Internal migration over the past 25 years has caused urban populations in many developing countries to grow at very high rates (more than 6 percent annually). (World Bank 1996, 4) Of the 10 largest cities in the world, 7 are in developing countries. Three-quarters of the Latin American population now lives in cities and towns. In Asia, however, urbanization has not occurred so rapidly, and most people still live in rural areas, but the World Bank expects urban

[15] This regional data is for selected countries only. (IEA 1994a, 96)

areas to account for 50 percent of the total population in East Asia by 2005 and in South Asia by 2025. (World Bank 1993a, 10)

Urbanization has mixed impacts on mobility. It can stimulate demand for passenger transport, including private automobiles. If urban transportation infrastructure is inadequate to meet demand, however, constraints on economic growth and personal mobility can occur, with the poor affected the most negatively. Attracted to megacities by the possibility of employment, poor people often must live in the less expensive, outlying areas, which can mean long, expensive trips to work. For example, commuting by public transportation takes 14 percent of the income of the poor of Manila, twice that of higher income brackets. (World Bank 1996)

Transportation patterns in non-OECD countries are affected by both national actions and those of international funding agencies. State control of transportation services is beginning to ease, largely forced by international lending agencies as conditions for loans. Other national policies of developing countries have varied, but include taxes or subsidies on gasoline and diesel, tariffs on imported vehicles, often to protect local industry, and the traditional building of infrastructure. Brazil has a longstanding policy to help sugarcane growers by subsidizing ethanol as a vehicle fuel. In 1996, Brazil eliminated limits on the use of natural gas in vehicles to benefit employment and the environment, and to strengthen economic ties with other Latin American countries with significant natural gas reserves. (Philpott 1996) The Chinese policies of several decades ago that forced residences to be built near workplaces partly contributed to greater bicycle usage, although it was not until economic reforms were introduced in 1979 that bicycles appeared in larger numbers. A number of cities in Latin America have created special busways that carry large numbers of passengers.

In some countries, government policies combined with other factors have changed the way income levels affect automobile ownership. Singapore had only 106 cars per 1,000 inhabitants despite a per capita gross national product (GNP) of $23,360 in 1994. Singapore is a small city-state with extensive subway and bus systems, and government policies that have significantly raised the costs of automobile ownership. (USDOT BTS 1996b) In comparison, at 128 cars per 1,000 inhabitants in 1994, Malaysia had an ownership rate slightly above Singapore's, but a GNP per capita of only $3,520. IEA attributes Malaysia's high ownership rate to a well-developed road network and its domestic car assembly industry.

Trends by Region: Freight Activity

OECD Countries

This section reviews freight activity in the OECD, as represented by Western Europe and the countries of Japan, Canada, and Mexico.

► Western Europe

Domestic freight activity in Western Europe expanded 2.3 percent annually between 1970 and 1994, with great variation among countries. The average annual growth rate was faster in southern Europe; domestic freight traffic increased by 4 percent in Italy and 4.6 percent in Spain during the period (see table 10-7).

The most notable freight trend is the changing modal share distribution (see table 10-8 and figure 10-5). Road transportation is dominant, with a 71 percent share of mtk. Its growth averaged 3.7 percent annually from 1970 to 1994, measured in ton-kilometers. Road transportation now captures the majority of domestic freight markets in all European countries, except Austria and the Netherlands. (ECMT 1995b and 1996a)

Table 10-7.

Domestic Freight Activity in Western European Countries: 1970 and 1994

(Billion metric ton-kilometers[1])

	Total domestic freight		Rail		Road		Inland waterways		Pipelines	
Country[2]	**1970**	**1994**	**1970**	**1994**	**1970**	**1994**	**1970**	**1994**	**1970**	**1994**
Western Europe	839.3	1,430.0	249.0	226.6	420.6	1,010.2	105.8	107.6	65.3	85.6
Austria	17.7	29.3	9.9	12.4	2.9	8.1	1.3	1.8	3.6	7.0
Belgium	28.0	48.6	7.9	8.2	13.1	34.1	6.7	5.2	0.3	1.1
Denmark	9.7	12.6	1.9	2.0	7.8	9.5	U	U	U	1.1
Finland	23.1	38.4	6.3	10.0	12.4	24.8	4.4	3.6	U	U
France	174.8	200.2	67.6	49.7	66.3	122.1	12.7	5.6	28.2	22.8
Germany[3]	212.4	347.7	70.5	64.2	78.0	211.6	48.8	57.6	15.1	14.3
Greece	7.7	12.5	0.7	0.6	7.0	11.9	U	U	U	U
Ireland	U	5.7	0.6	0.6	U	5.1	U	U	U	U
Italy	86.3	222.6	18.1	22.9	58.7	187.5	0.4	0.1	9.1	12.1
Luxembourg	1.2	1.7	0.8	0.7	0.1	0.7	0.3	0.3	U	U
Netherlands	50.9	67.5	3.7	3.0	12.4	26.0	30.7	33.0	4.1	5.5
Norway	4.7	14.6	1.5	1.6	3.2	8.9	U	U	0.0	4.1
Portugal	U	11.8	0.8	1.8	U	10.0	U	U	U	U
Spain	63.0	186.9	10.3	9.1	51.7	172.3	U	U	1.0	5.5
Sweden	35.1	44.6	17.3	18.7	17.8	25.9	U	U	U	U
Switzerland	12.2	20.6	6.6	8.1	4.2	11.1	0.2	0.2	1.2	1.2
United Kingdom	112.5	164.7	24.5	13.0	85.0	140.6	0.3	0.2	2.7	10.9

[1] Excludes domestic air freight and coastal shipping.
[2] Data for 1994 for Western Europe for road, inland waterways, and total domestic freight are European Conference of Ministers of Transport estimates. Data for Belgium, Ireland, and Greece for 1994 were not available; 1991 data are used here. Data for the Netherlands, Portugal, and Sweden for 1994 were not available; 1993 data are used here.
[3] German data for 1970 include only the former Federal Republic of Germany and West Berlin. Data for 1994 were not available; 1993 data are used here. Data for 1993 are inclusive of both the former East and West Germany

KEY: U = data are unavailable.

SOURCES: European Conference of Ministers of Transport. 1995. *Activities of the Conference: Resolutions of the Council of Ministers of Transport and Reports Approved in 1995.* Paris, France: OECD Publications Service.
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In contrast, freight rail experienced slow or negative growth and declining modal share in recent decades. Overall, domestic rail activity in Western Europe fell an average of 0.4 percent annually between 1970 and 1994, and its modal share fell from 30 to 16 percent. In a few countries (e.g., Austria and Switzerland), rail activity increased, although even in these cases, modal share fell. European governments and industries recognize the declining position of rail and the problems of sustaining freight rail (see box 10-4).

Transportation by inland waterways is less important than road or rail in Western Europe. The level of inland waterway transport remained almost constant between 1970 and 1994, but its modal share declined from 13 to 8 percent. For a

Table 10-8.

Domestic Freight Activity, Selected Countries and Regions

(In billions of metric-ton kilometers[1])

Country/ region	Year	Rail	Road	Inland waterways	Coastal shipping	Pipeline	Total domestic freight	Average annual growth rate in freight activity	Real average annual GDP rate
OECD countries									
United States	1970	[2]1,116.6	[3]602.0	[4]343.4	525.3	629.2	3,216.5	2.0%	2.8%
	1994	[2]1,753.0	[3]1,326.0	[4]519.8	668.1	863.4	5,130.3		
Canada[5]	1984	[6]184.3	[7]43.6	[8]39.3	29.4	U	296.6	0.3%	2.5%
	1994	[6]193.2	[7]60.1	[8]29.6	22.6	U	305.5		
Mexico[9]	1980	41.3	82.2	U	18.3	U	141.8	2.5%	1.6%
	1993	35.7	139.7	U	19.4	U	194.8		
Japan[10]	1970	63.4	135.9	U	151.1	U	350.5	2.2%	4.2%
	1991	27.2	281.6	U	248.2	U	557.0	(1970–91)	(1970–92)
Western Europe[11]	1970	249.0	[12]420.6	[13]105.8	U	[14]65.3	839.3		
	1994	226.6	[12]1,010.2	[13]107.6	U	[14]85.6	1,430.0	2.3%	U

[1] Excludes domestic air freight. Includes domestic coastal shipping where applicable and when available.
[2] Class I railroads only. Rail figures are based on revenue metric ton-kilometers.
[3] Data are for intercity truck metric ton-kilometers only, and therefore are underrepresented.
[4] Great Lakes and inland waterway traffic.
[5] Data for 1970 were unavailable.
[6] Class I and Class II railroads only.
[7] Data are for for-hire Class I and Class II road carriers only, and therefore are underrepresented. The classification of Class I and Class II truck carriers changed between 1984 and 1994. In 1987, Class I and Class II establishments were those with gross operating revenues of CAD$350,000 and greater. From 1988 to 1989, Class I and Class II establishments were those with gross operating revenues of CAD$500,000 and greater. From 1990 to 1994, Class I and Class II establishments were those with gross operating revenues of CAD$1 million and greater. Because of these definitional changes, the level of domestic road activity in Canada may be underestimated.
[8] The majority of this activity is Great Lakes traffic.
[9] Data for 1970 and 1994 were not available.
[10] Data for 1994 were not available.
[11] Includes Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the United Kingdom. Data for 1994 for road, inland waterways, and total domestic freight are Economic Conference of Ministers of Transport estimates. Data for Belgium, Ireland, and Greece for 1994 were not available; 1991 data were used for these countries, and included in the 1994 totals for Western Europe. Data for the Netherlands, Portugal, and Sweden for 1994 were not available; 1993 data were used for these countries, and included in the 1994 Western European totals. German data for 1970 included in the 1970 Western European totals were only for the former Federal Republic of Germany and West Berlin. German data for 1994 were not available; 1993 data were used in the Western European 1994 totals. German data for 1993 includes both the former East and West Germany.
[12] Road totals for 1970 do not include Ireland or Portugal.
[13] Inland waterway totals for 1970 and 1994 do not include Denmark, Greece, Ireland, Norway, Portugal, Spain, and Sweden due to inapplicability or unavailability of data.
[14] Totals for 1970 and 1994 do not include Finland, Greece, Ireland, Luxembourg, Portugal, and Sweden due to inapplicability or unavailability of data. Data for Denmark were not included in 1970 Western European totals, but were included in 1994 totals.

few countries, inland waterways remain vital. Germany and the Netherlands, with their proximity to the Rhine River, moved 17 percent and 49 percent, respectively, of their domestic freight by this mode in 1993. (ECMT 1995b and 1996c)

Economic growth, geography, and government policies (both national and trans-European) influence the level and nature of European freight transport. Relatively consistent and, in some cases, rapid economic growth contributed to the strong increase in freight activity in many countries between 1970 and 1990. Slower economic growth and a general recessionary environment between 1990 and 1994,

Table 10-8.

Domestic Freight Activity, Selected Countries and Regions *(continued)*

(In billions of metric-ton kilometers[1])

Country/ region	Year	Rail	Road	Inland waterways	Coastal shipping	Pipeline	Total domestic freight	Average annual growth rate in freight activity	Real average annual GDP rate
Former East Bloc (FEB) countries									
Czech	1970	U	U	U	NA	U	U		
Republic	1994	23.2	22.7	1.3	NA	2.2	49.4	U	U
Hungary	1970	19.8	5.8	1.8	NA	1.0	28.4	2.6% (1970–85)	U
	1994	7.7	13.0	1.4	NA	4.2	26.3	–5.0% (1985–94)	U
Poland	1970	99.3	15.8	2.3	U	7.0	124.4	2.3% (1970–85)	U
	1994	65.8	45.4	0.8	U	14.3	126.3	–3.6% (1985–94)	2.2% (1970–94)
Russian Federation[15]	1970	1,706	116	168	412	243	2,645	3.4% (1970–89)	U
	1992	2,250	263	183	470	1,070	4,236	–5.5% (1989–92)	U
Non-OECD countries									
China[16]	1970	349.6	13.8	51.2	U	U	414.6		
	1992	1,157.6	375.6	422.2	U	61.7	2,017.1	7.5%	7.5%

[15] Freight statistics are estimates derived by the World Bank from national statistics of the former Soviet Union. Data were not available for 1994.
[16] Data for 1994 were unavailable.

KEY: GDP = gross domestic product; NA = not applicable; U = unavailable.

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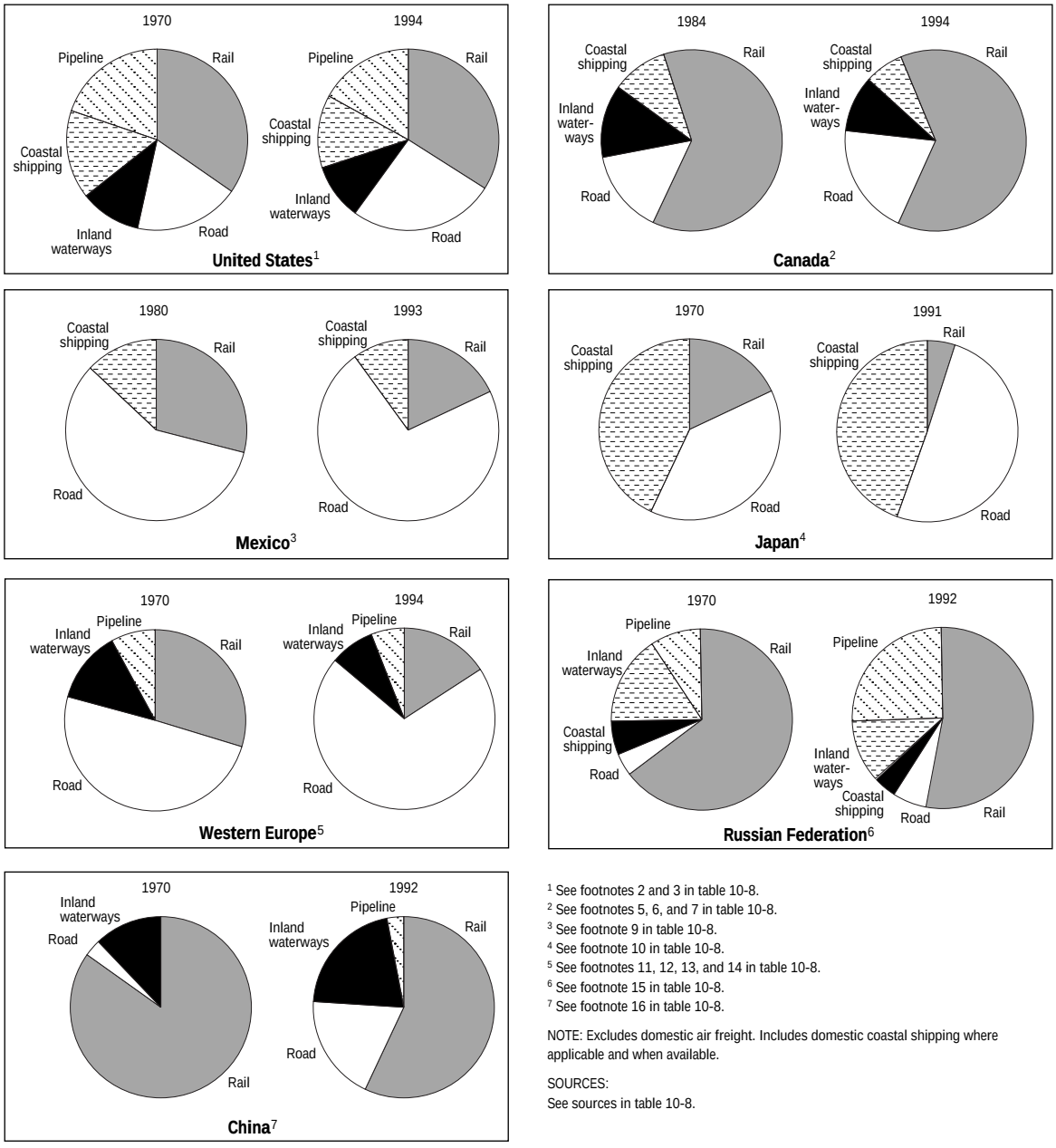
For China: Ministry of Communications. 1992. *Statistical Yearbook of China 1992.* Beijing.

Figure 10-5.
Domestic Freight Activity by Mode in Selected Countries and Regions

(Percentage of total metric ton-kilometers)



[1] See footnotes 2 and 3 in table 10-8.
[2] See footnotes 5, 6, and 7 in table 10-8.
[3] See footnote 9 in table 10-8.
[4] See footnote 10 in table 10-8.
[5] See footnotes 11, 12, 13, and 14 in table 10-8.
[6] See footnote 15 in table 10-8.
[7] See footnote 16 in table 10-8.

NOTE: Excludes domestic air freight. Includes domestic coastal shipping where applicable and when available.

SOURCES:
See sources in table 10-8.

however, led to diminished freight growth. Notably, though, as Europe's manufacturing industries became more dispersed, countries in southern Europe (e.g., Italy and Spain) experienced more rapid economic and freight activity growth than the European average. In addition, the small physical size of many European countries has influenced the relative importance of different modes.

Until recently, each country had its own transportation policy, despite recognition of the benefits of integration. In national markets, freight transportation has often been heavily controlled. In many European countries, state-owned entities operated freight transportation, especially rail. European countries have also limited truck haulage capacity and prices charged in national markets, although in many countries, such practices have changed significantly in the past 10 to 15 years. State-owned or controlled entities have been privatized, and price and market entry controls relaxed, especially in road transport. In 1987, the European Conference of Ministers of Transport (ECMT) agreed to the deregulation of international road haulage. In 1992, the transport of goods within a country by a nonresident hauler was liberalized.

In response to concerns about the growing dominance of road transportation, with associated congestion and environmental impacts, national governments and the EU have started to promote rail, inland waterways, and intermodalism. Notable are the rail and intermodal projects of the EU's Trans-Europe Transport Network initiative.[16] Many policymakers see intermodal transportation as improving the performance of rail and reducing the negative impacts of trucks. In 1995, the EU created the Task Force on Transport Intermodality in order to develop a consistent and effective European approach to intermodalism. Several studies have been conducted to determine the principal European opportunities for intermodal freight transport. In June 1996, an American rail company—CSX Corporation—joined forces with Dutch and German railways to form a joint venture, NDX International, which aims to create a door-to-door intermodal freight network in Europe. (*Railway Age* 1996)

[16] In December 1994, the European Council of Heads of Government established 14 transport network projects as priorities for the EU, at an estimated cost of US$500 billion.

► Japan

Japanese domestic freight activity expanded an average of 2.2 percent annually between 1970 and 1991 (see table 10-8). (JTERC 1995) The most notable trends are the rising dominance of road transportation and the continued importance of domestic coastal shipping. Together, trucks and coastal shipping account for 96 percent of Japan's domestic freight activity.

Road transportation grew an average of 3.5 percent between 1970 and 1991, capturing a 51 percent modal share in 1991, up from 39 percent in 1970 (see figure 10-5). (JTERC 1995) In this island nation, coastal shipping is vital to domestic freight transport. Although its recent growth (2.4 percent annually) has been slower than road transport, coastal shipping has held its modal share steady, at about 44 percent in both 1970 and 1991. In contrast, rail fell an average of 4 percent a year, and by 1991, rail held less than 5 percent of the freight modal share in Japan, down from 18 percent in 1970. (JTERC 1995)

Structural economic and manufacturing changes explain the differences in domestic freight markets in Japan between 1970 and 1991. Along with changes in manufacturing practices, the Japanese economy shifted from primary and raw materials production to high-technology manufacturing and services. The Japanese road transportation sector responded effectively to this shift and to shippers' demands for speed, reliability, and high levels of service.

Box 10-4.

The Challenge of Sustaining Western European Freight Rail

A notable trend in Western European transportation of the past 25 years has been the decline in rail freight. Rail haulage fell an average of 0.4 percent a year during this period, and in 1994 rail accounted for less than 16 percent of domestic metric ton-kilometers in Western Europe, compared with 30 percent in 1970 (see table).

There are several causes for the decline in rail market share. The changing business environment demands just-in-time deliveries and customer responsiveness often better suited to trucking. In addition, until recently little development and improvement of important trans-European rail routes has occurred, even though growth in international rail traffic has been notably stronger than domestic. Western Europe's collection of unintegrated rail systems and services makes expansion difficult. Spain and Portugal, for example, have a different track gauge from the rest of the European Union (EU). The prevalence of state-owned or controlled railroads has also made them less responsive to market conditions, and the coordination of trans-European rail policies and services has been difficult.

Some countries have continued moderate growth and high market share for domestic freight rail; in Sweden, Austria, and Switzerland, rail's share of domestic freight is approximately 40 percent. In other countries, notably Italy, Spain, and the United Kingdom, rail's share dropped to less than half of what it was in 1970, to stand at 10 percent

Domestic Freight Rail's Modal Share in Western European Countries

Country	Year	Percentage of total domestic mtk
Western European total	1970	30
	1994	16
Austria	1970	56
	1991	42
Belgium	1970	28
	1991	17
Denmark	1970	20
	1994	16
Finland	1970	27
	1994	26
France	1970	39
	1994	25
Germany[1]	1970	33
	1993	19
Greece	1970	9
	1991	5
Ireland	1970	U
	1991	11
Italy	1970	21
	1994	10
Luxembourg	1970	67
	1994	41
Netherlands	1970	7
	1993	4
Norway	1970	32
	1994	11
Portugal	1970	U
	1993	14
Spain	1970	16
	1994	5
Sweden	1970	49
	1993	42
Switzerland	1970	54
	1994	39
United Kingdom	1970	22
	1994	8

[1] German data for 1970 include only the former Federal Republic of Germany and West Berlin. German data for 1993 are inclusive of both the former East and West Germany.

KEY: mtk = metric ton-kilometers; U = data are unavailable.

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C.A. Nash. 1996. Integrating Transport Networks. *Transport: New Problems, New Solutions.* Paris, France: OECD Publications Service.

Box 10-4.

The Challenge of Sustaining Western European Freight Rail *(continued)*

or less of total domestic freight movement by 1994. The differences between these countries are due to the interaction of a variety of factors including commodity mix, length of haul, and competitive conditions within rail and with other modes. Government policies also played a role. Switzerland and Austria, both important European freight transit[1] countries, have regulations that protect their domestic rail markets and reduce environmental emissions. Switzerland effectively banned most through truck traffic by imposing a maximum weight limit of 28 metric tons (31 tons) for trucks as opposed to the 40 metric ton limit (44 tons) to which member countries of the EU adhere. Subsequently, Switzerland and the EU agreed on a quota of 50 trucks of 40 metric tons per day, which can be surpassed only if all Swiss rail capacity has been used. Austria also instituted policies to promote rail transportation and limit road freight by banning non-Austrian truck traffic from its road network at night.

The ability of Austria, Switzerland, and Sweden to retain a significant market share for rail is an exception in Western Europe. European policymakers consider the decline in rail freight a disturbing trend. They hope that rail will regain some of its lost modal share through the development of additional rail infrastructure via Trans-European Network projects, the introduction of greater market incentives, and the expansion of railroads into the intermodal market.

[1] Transit in this case refers to goods or vehicles passing through a location.

In response to concerns about the growing dominance of road transport and its effect on the environment and congestion, the Japanese government initiated several efforts to promote rail freight and coastal shipping. Working with industry and the newly privatized railways, the government is promoting rail capacity expansion and making rail more convenient for shippers. The initiatives include developing intermodal facilities and increasing the number of cars per train and train speeds. In coastal shipping, starting in 1991, government implementation of an investment and improvement strategy for Japan's ports and harbors has included the further development of container terminals for domestic and foreign trade. Because these initiatives are coming at the same time that the Japanese government is relaxing regulations on road transportation (including simplification of licensing procedures and limited deregulation of rates), the ultimate impact on freight transportation is unclear.

► Canada

Domestic freight transportation in Canada expanded slightly between 1984 and 1994, although national statistics may not reflect the true level of activity.[17] Domestic freight activity increased an average of 0.3 percent annually between 1984 and 1994 (see table 10-8). Growth in Canada's dominant mode—rail—was limited, and inland waterways traffic (primarily on the Great Lakes) declined an average of 2.8 percent annually, while road activity increased 3.3 percent. (Transport Canada 1996a) Road and rail gained modal share between 1984 and 1994, with inland waterways and domestic coastal shipping losing. According to national data, rail accounted for approximately 63 percent of domestic freight activity in 1994, and road transport for 20 percent (see figure 10-5).

[17] Canadian rail figures include Class I and Class II railroads only, while road figures include only for-hire Class I and Class II carriers. Because of this, both modes, especially road transport, may be underrepresented. The classification of Class I and Class II truck carriers changed between 1984 and 1994. In 1987, Class I and Class II establishments were those with gross operating revenues of CAD$350,000 and greater. From 1988 to 1989, Class I and Class II establishments were those with gross operating revenues of CAD$500,000 and greater. From 1990 to 1994, Class I and Class II establishments were those with gross operating revenues of CAD$1 million and greater. Because of these definitional changes, the level of domestic road activity in Canada may be underestimated.

Several factors, including recent economic performance, government policies, and geography, help to explain Canadian freight activity. Slow economic growth in the late 1980s and early 1990s constrained domestic freight activity during this period. Canada also saw a limited shift in output and employment away from resource-based industries toward manufacturing, knowledge-based, and service industries, affecting the level of freight activity and the relative importance of modes. As the world's second largest country in land area, geography plays an important role in Canada's freight transportation. For trans-Canadian freight transportation, rail has obvious competitive advantages, while road transportation has been an important mode in the manufacturing centers and large cities in the eastern provinces.

The Canadian government has initiated several reforms that could affect the development of the country's domestic freight market. The changes are intended to stimulate greater competition and efficiency in freight transportation. In 1988, the National Transportation Act (NTA) and the Motor Vehicle Transport Act (MVTA) went into effect. The NTA reshaped the freight negotiating framework for shippers and railroads and granted new rights for shippers to access competing railroads. The MVTA reduced the licensing requirements for motor carrier drivers. In 1995, Canadian National Railway, the country's largest and state-controlled freight railroad, was privatized in the biggest equity offering in Canadian history, raising more than US$1.2 billion in cash, plus real estate valued at $300 million. In July 1996, Canada also passed a new Canadian Transportation Act, which is intended to modernize and streamline rail regulation, promote the formation of short-line railways, reduce unnecessary motor carrier regulations, and ensure shippers' access to competitive transportation. (Anderson 1996)

► Mexico

Road dominates freight transportation in Mexico to a greater degree than in most other countries discussed in this chapter (see figure 10-5). Rail and, for geographical reasons, coastal shipping account for most of the rest of Mexico's domestic freight market. As in many other countries, air freight is growing rapidly, but still accounts for less than 1 percent of domestic mtk. (SCT/IMT 1995) Overall, domestic freight activity expanded 2.5 percent annually between 1980 and 1993 (see table 10-8).

Between 1980 and 1993, domestic road transport grew, on average, 4.2 percent per year, increasing its modal share from 58 percent in 1980 to 72 percent in 1993. During the same period, rail activity dropped by 1.1 percent annually, reducing rail's share of domestic freight from 29 percent in 1980 to 18 percent in 1993 (see figure 10-5). (SCT/IMT 1995) The decline in growth can be attributed to several factors, including worldwide business and production changes that favored trucking. (Mexican data were not available to assess the impact on domestic freight activity of the December 1994 peso devaluation.)

Government policies and structural economic changes have influenced Mexican transportation. Reform of freight transportation began in the 1980s. The trucking sector, which had been organized into regional cartels with government-regulated tariffs, was deregulated in 1989. The World Bank estimated that efficiency gains (lower rates, higher quality service, and increased flexibility) from deregulation will amount to more than US$500 million annually. (World Bank 1995b, 57) Privatization and restructuring of domestic air transportation began in 1988, followed by deregulation of domestic airfares in 1991. Extensive privatization of Mexico's ports started in 1992, and privatization of the national railroad, Ferrocarriles

Nacionales de Mexico (FNM), officially began in 1996.

As part of privatization, FNM's rail lines were divided into five regional sections, with private firms allowed to bid on rights to the lines. Foreign companies have been allowed to bid for up to a 49 percent interest, and U.S. railroad companies are involved through alliances with Mexican investors and companies. In December 1996, an alliance between Transportacion Maritima Mexicana, Latin America's largest integrated transportation company, and Kansas City Southern Railway (KCS), a regional U.S. railroad, won the first operating concession under the FNM privatization. The alliance, known as Transportacion Ferroviaria Mexicana, will operate Mexico's Ferrocarril del Noreste for 50 years, with the option of an additional 50-year extension.

While rail infrastructure development has been limited until very recently, Mexico has engaged in intensive roadway development since the mid-1980s. Between 1989 and 1994, approximately 4,100 kilometers (2,548 miles) of new four-lane highways were constructed in Mexico. Because the government could not afford this level of investment alone, several public/private financing strategies were employed. State-owned banks and private construction companies financed and built the majority of new highways, which are primarily access-controlled toll roads. Construction costs have been estimated at $10 billion to $15 billion. (World Bank 1995b and LBJ 1995). Private sector consortia bid on concessions to finance, build, and operate toll roads. Generally, the government awarded concessions to companies that offered the shortest concession period, and many periods were quite short, some under 10 years. As a result, some of the private sector consortia charged relatively high tolls to recoup their initial investment in construction. Consequently, Mexico had some of the highest tolls in the world—an average of 18¢ per kilometer, second only to Japan at 20.5¢ per kilometer. (LBJ 1995) High tolls led to lower than expected traffic volume, particularly among truckers who continued to use the older, more direct roadways connecting population and manufacturing centers. Beginning in 1993, the Mexican government increased the concession periods for several of the country's major tollways, with mixed results so far.

Former East Bloc Countries

Domestic freight activity in FEB countries has fluctuated during the past 25 years, expanding an average of 2.2 percent annually in Poland, Latvia, and Russia, and almost 3 percent per year in Romania, Bulgaria, and Hungary between 1970 and the mid-1980s. Economic and political difficulties, however, contributed to a contraction and decline in freight activity since the late 1980s. Between 1985 and 1994, domestic freight mtk fell an average of 4 percent annually in Poland and Hungary, and 11 percent per year in Bulgaria, Romania, Lithuania, and Latvia. (ECMT 1995a) Russia experienced an average annual decline of almost 6 percent between 1989 and 1992 (see table 10-8). (World Bank 1993b)

Despite fluctuations, road mtk in several FEB countries had the most growth, increasing an average of 5 to 6 percent annually in Poland, Hungary, Latvia, and Russia through the mid- to late 1980s. These rates dropped slightly as overall freight and economic activity contracted between the mid- to late 1980s and 1994. Comparatively, however, road transportation's growth remained higher than other freight modes during this time. In Poland, for example, trucking continued to grow at an annual average of 5 percent between 1985 and 1994, while the sector's growth dipped slightly in Hungary to 3 percent annually. Trucking has increased its

modal share in several FEB countries. Available data suggest these trends are continuing. (Chatelus et al 1996)

Like most western European countries, the FEB is shifting from rail to road for freight. Although still the dominant freight mode in many FEB countries, rail grew only slightly between 1970 and 1985, and then began a notable decline. For example, between 1985 and 1994, rail fell an average of 5 percent annually in Poland and Latvia, and almost 12 percent per year in Romania and Hungary. (ECMT 1995a) In Russia, rail expanded 2.3 percent annually between 1970 and 1989, but fell 4.8 percent per year from 1989 to 1992. (World Bank 1993b) Consequently, rail lost modal shares in these countries. (ECMT 1995a) Poland saw rail's modal share decline from 80 percent in 1970 to 52 percent in 1994. In Russia, rail's modal share fell from 65 percent to 53 percent between 1970 and 1992. Since 1991, rail has been affected by the dissolution of the FSU and the establishment of independent republics.

Government policies were foremost among factors influencing the level and nature of freight activity in the FEB between 1970 and 1994. Until the late 1980s, domestic and international freight transportation in FEB countries was heavily regulated. The Council for Mutual Economic Assistance (CMEA) controlled trade and industrial production in the FSU. Under CMEA's centralized planning system, priority was given to basic industries, rail transportation, and internal CMEA trade flows. In this environment, most shipments of bulk commodities were pre-planned and sent by rail. Demand for road transportation was usually limited to short feeder trips in and around centers of industrial production.

FEB governments have begun to develop and implement new transportation policies, particularly deregulation and privatization of state-owned or controlled transportation. Road transportation was one of the first sectors deregulated in the FEB, because of the relative ease of reorienting it to market practices. The number of road transport operators in most countries increased quickly following deregulation and privatization. For example, many state road transportation entities were privatized simply by selling vehicles to drivers. In Poland, there are now over 80,000 road haulage firms. (Chatelus et al 1996, 134) In contrast, privatization and deregulation of road transportation is moving much more slowly in Russia, where the government continues to regulate rates.

As production in many FEB countries shifts to manufactured goods, road transportation may have a greater competitive advantage as shippers demand more flexible and responsive service. Moreover, changes in the location of manufacturing centers have the potential to affect the rail sector drastically, because the rail networks were built to serve the original centers. Furthermore, economic integration with Western European economies could affect freight demand and modal splits. Prior to 1989, the volume of trade between Eastern and Western Europe was relatively low, consisted primarily of bulk commodities, and typically was shipped by rail or inland waterways. In 1990, one year later, exports from Eastern Europe to Western Europe jumped by 23 percent, and in 1991 rose again by another 25 percent. (ECMT 1995d, 100) Many analysts believe trade between Eastern and Western Europe will continue to increase for the foreseeable future. One estimate projects that this trade will increase 4.25 percent annually between 1991 and 2010. (Michalak and Gibbs 1993)

Infrastructure, however, could constrain both rail and road service. Rail and road networks need maintenance, upgrading, and in some cases, more capacity. (ECMT 1995d) Some view the need for electrification of rail networks to be particularly acute. (Hall 1993) In addition, the

north-south orientation of rail networks in many FEB countries may slow the growth of western European trade by rail.

Other Non-OECD Countries

Because data are sparse for many non-OECD countries, this section concentrates on freight transport in China and India. Data for these countries show two broad trends: 1) an expansion of freight activity, although increases vary by country; and 2) an increasingly important role for road transportation, generally at the expense of rail. Similar to the passenger transportation trends in non-OECD countries discussed earlier in this chapter, economic, political, and institutional factors, and the level and condition of infrastructure interact to influence freight activity in both these countries.

► China

Freight activity in mtk expanded rapidly, at an average of 7.5 percent annually between 1970 and 1992, in step with the country's rapidly expanding economy (see table 10-8). (World Bank 1995a) During this period, starting from a low base, road transportation grew an average of 16.2 percent annually, and increased its modal share from 3 percent to 19 percent. Rail activity increased on average 5.6 percent per year, but its modal share dropped from 84 percent to 57 percent (see figure 10-5).

In addition to strong economic growth, government policies designating special export and regional trading zones and trade cities affected the level and nature of freight activity. The fastest growth in freight transport activity occurred in the coastal provinces, where the trade zones and cities are concentrated.

Moreover, shifts away from raw materials processing to the production of higher value and lighter products, often for export purposes, prompted increased demand for faster, more flexible transport. China's emerging road transportation sector, while limited by capacity and regulatory constraints, is beginning to meet these demands. Continued growth in road freight will depend on expanding the highway infrastructure, increasing the number of trucking operators, and fostering competition. In relation to its population and geographic area, China's highway network is among the smallest in the world, and many roads are in poor condition. Over the next several years, China plans to construct 14,500 kilometers (9,010 miles) of high-grade national highways as part of its National Trunk Highway System. (World Bank 1995a, 1) Competition among road transportation services will also affect demand; competition is currently limited by granting monopoly franchises along product and geographic lines.

Although rail's share of domestic freight has fallen over the last few decades, rail continues to be the backbone of China's distribution system, especially for bulk commodities. As the Chinese economy becomes more market-oriented and more geared to manufacturing, rail may lose modal share to road transportation. Rail, however, is likely to retain a strong role in bulk commodities and interregional transport, although limited infrastructure capacity may be a constraint. China already faces bottlenecks on several rail networks. The Ministry of Rail has started to expand the capacity of existing lines through double tracks and electrification, providing new locomotives and rolling stock, and building new lines, such as the Beijing to Hong Kong line. (World Bank 1994b and 1995a)

► India

Indian domestic freight activity has also expanded rapidly in recent decades, with intercity freight increasing an average of 5.3 percent

annually between 1967 and 1987.[18] As in China, freight transportation in India is shifting from rail to road. (World Bank 1995b)

Intercity road transportation has led India's freight expansion, growing by 8.8 percent annually between 1967 and 1987. In 1985, intercity trucking overtook rail and accounted for approximately 52 percent (200 billion mtk or 137 billion ton-miles) of freight activity. Deregulation of intercity road transportation in 1986 spurred additional growth, with the modal share rising to 60 percent (384 billion mtk or 263 billion ton-miles) by 1992. The number of operators jumped after deregulation, and road transportation prices became more competitive with those of rail. (World Bank 1995b)

Rail growth was slower (3.3 percent annually between 1967 and 1987), and the sector's modal share declined from 48 percent of the domestic intercity freight market in the late 1980s to 39 percent in 1992. As rail's freight share declined, India's state-owned rail company focused more on passenger transport. (World Bank 1995b)

Lack of infrastructure may constrain the growth of road transportation. India's major urban areas are connected by high-density corridors (HDCs), totaling about 30,000 kilometers (18,641 miles) in length. They are straining to carry nearly 40 percent of passenger and freight traffic, while accounting for only 2 percent of the nation's total road length. According to the World Bank, India's road infrastructure, most particularly the HDCs, has not expanded sufficiently in the last 10 years. If trucking continues to dominate Indian freight, and if the passenger motor vehicle fleet continues to expand (as all signs indicate it will), there will be more congestion and bottlenecks. The government is considering a system of partially toll-financed express highways as a way to increase road capacity.

[18] National statistics on freight activity in India were not available. The World Bank estimates used here reflect only intercity freight transportation and therefore underrepresent domestic freight activity in India.

Implications of Changing Passenger Mobility and Freight Activity

With the exception of some very-low-income countries, passenger travel and freight activity are increasing worldwide. This increase in transportation activity has brought broad benefits to people in countries throughout the world, as well as some unintended consequences. People and governments worldwide are taking many steps to maximize benefits and minimize costs, some of which are highlighted below.

Economic and Social Effects

The transportation system in countries throughout the world has made possible an unprecedented level of mobility, which has enlarged the geographic choices available to people and businesses. This mobility has given many people more options about where to live, work, shop, find medical care, and enjoy leisure time than they had a few decades ago. Similarly, mobility has facilitated access of businesses to new markets, given firms more choices about where to locate facilities, broadened their range of suppliers, and increased the available pool of workers.

From the economic perspective, transportation is vital in any country. It supports jobs and economic activity, enables the transfer of goods, and expands the choices available to consumers to be able to purchase goods from other localities and countries. The trade facilitated by transportation has been a growing component of national income in many countries. The contribution of transportation to national economies varies from country to country. As discussed in chapter 2, transportation-related final demand

has contributed about 11 percent to the U.S. GDP since 1989. Comparable estimates for other countries, based on the same methodological approach used by the United States in calculating transportation's share of GDP, are not available.

Consumer expenditures on transportation also signal the value of transportation to a society. In 1994, transportation accounted for 19 percent of total consumer expenditures in the United States. (USDOL BLS 1994) In the European Union in 1991, transportation averaged 14.6 percent of total personal consumption. (EC 1994, 16) Australian households were spending $3,045[19] on transportation in the early 1990s, about half of the U.S. household's average of $6,044 in 1994. (Australian Bureau of Statistics 1993)

Every nation invests in transportation infrastructure. Western European countries invested an average of 1 percent of GDP in the late 1980s, down half a percent from their 1975 level. (ECMT 1992) In the 1980s, Latin American countries invested 0.7 percent of their GDP in transportation infrastructure, down from 1.6 percent in the 1970s, while countries in East Asia and the Pacific invested 1.6 percent. The World Bank attributes the decline in investment in Latin America to the region's debt crisis in the 1980s. (World Bank 1994c)

Environmental Effects

Environmental impacts of transportation, particularly air pollution, are a continuing problem in the OECD and FEB countries and a growing problem for developing countries. Air pollution from motor vehicles can be severe in congested urban areas, and can contribute to health problems. Some countries with very high per capita passenger travel and freight activity, such as the United States, have reduced key categories of air emissions even as transportation has grown rapidly.

Success is uneven, however. For example, carbon dioxide emissions from motor vehicles are a major component of greenhouse gases, which have the potential to change the global climate (see chapter 4). Thus, growth in passenger travel and freight shipments, combined with a shift to road transportation, are key contributing factors to environmental problems. (For a comprehensive review of international trends in air pollution from motor vehicle use, see *Transportation Statistics Annual Report 1996*.)

Road Congestion

Congestion slows movement, inflicting direct and indirect costs on people, businesses, and nations. Congestion also increases pollutant emissions and fuel consumption.

In the last 20 years, vehicle speeds have declined in major OECD cities. (ECMT 1995e) Severe road congestion has been reported in non-OECD countries.[20] Urban traffic congestion in Latin America and other regions delays travel, affecting the efficiency of goods distribution and contributing to air pollution. (World Bank 1994c)

Countries employ a variety of strategies to reduce congestion, such as expanding infrastructure, traffic management, promoting public transportation, and implementing policies to minimize the attractiveness of cars. New infrastructure may decrease congestion, increase average speeds, and shorten routes, but some studies suggest that it may also encourage demand, caus-

[19] Converted from Aus$3,959 at 1.3 Aus$/US$ (as of January 6, 1997). The original figure was Aus$76.13 per week.

[20] For a complete discussion of the causes of congestion in developing countries, see *Transportation Statistics Annual Report 1996*.

ing increased driving and thus more emissions. (World Bank 1994d; Hook 1996) Some countries use regulations and incentives in their efforts to reduce motor vehicle use and curb congestion.

Safety

Inconsistencies in definitions and reporting criteria prevent a thorough comparison of transportation safety among various countries. Motor vehicle crashes tend to be less severe in the United States (with 13 fatalities per 1,000 casualties) than in other industrialized countries (15 to 48 fatalities per 1,000 casualties). (USDOT BTS 1996b) According to ECMT, deaths from road accidents in Western Europe between 1970 and 1993 were the lowest in 1985, when 54,000 people died. Fatalities then rose to an estimated 55,140 in 1992. (ECMT 1994)

Worldwide, an estimated 885,000 people died in traffic accidents in 1993. A majority of the deaths were in developing countries. A high proportion of the fatalities and injuries are suffered by pedestrians. (WRI 1996) In India, for example, only 5 percent of those killed or critically injured are in cars. The rate of fatalities per vehicle declines sharply as a country's income rises, with over 80 fatalities per 10,000 vehicles in low-income countries and under 10 fatalities per 10,000 vehicles in high-income countries. Fatalities per capita, however, tend to rise with income, with upper-middle-income countries having the highest rate (200 fatalities per million inhabitants). (World Bank 1996, 65)

Energy Consumption

Transportation is a major—and growing—consumer of energy, primarily petroleum. The major consequences of transportation energy use are the national costs of fuel imports and environmental impacts. Most countries are net importers of petroleum. The implications of oil import dependency are discussed in chapter 4.

Improving the efficiency of fuel use can mitigate both import costs and some environmental problems. Today's stock of motor vehicles, especially passenger cars, in OECD countries is newer and more energy efficient than is the stock in non-OECD countries. Despite this, overall energy use is lower in developing countries, where bus and rail still prevail and where incomes are low. Efficiency gains obtained by OECD countries are beginning to taper off as motorists shift to heavier cars, trip distances increase, and congestion grows.

Some non-OECD countries are beginning to implement fuel efficiency programs. For example, Slovenia has banned the import of cars that are older than three years. Some also have imposed taxes on gasoline fuels as high as those in Western Europe. Still, in 1994, the average price for premium gasoline in developing countries was half that of the Western European average. (World Bank 1996)

Countries worldwide are starting to make commitments to reduce emissions of greenhouse gases under the international Framework Convention on Climate Change. Japan, Germany, Switzerland, and the United Kingdom have established new transportation fuel efficiency reduction targets. The Ontario province of Canada has introduced a tax on new vehicle purchases, based on the vehicle's fuel consumption rate. (IEA 1996b)

Technology Solutions

The application of information technologies and intelligent transportation systems (ITS) has

important implications for passenger travel and freight activity worldwide. The use of information technologies in the U.S. transportation system is discussed in detail in chapter 11. In Europe, the use of such technologies in transportation is called transport telematics (see box 11-5 in chapter 11). ITS has many potential applications in such areas as safety, congestion mitigation, and energy efficiency.

Although technology holds great promise for reducing costs and enhancing benefits of transportation, a combination of public policies, business practices, and personal choices will affect its implementation and use.

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